CONFIDENTIAL

1990

PM USA R&D

STRATEGIC PLAN

Draft

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Summary and Plan

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EXECUTIVE SUMMARY

The 1989 PM USA R&D Five Year Strategic Plan is based on thorough analysis of the PM USA five year goals; our current environment, including our competitors, suppliers, and available technology; and the future factors which are anticipated to impact our business during the plan period. PM USA will face significant challenges in the coming five year period. Of these challenges, twenty-five have been identified which have the potential of significantly impacting R&D programs and resources. Those challenges can be classified into six major areas, namely:

1. Competitive Pressures
2. Social & Political Influences
3. Market Dynamics
4. Reliance of R&D on Suppliers
5. Internal Environment
6. External Factors

For each factor, the most likely scenario was identified. Alternate scenarios are also provided where appropriate. Based on the consideration of all of these factors listed above, six strategic goals were formulated:

1. AGGRESSIVELY SUPPORT THE CURRENT BUSINESS.

2. DEVELOP PRODUCTS WHICH ADDRESS THE CONSUMERS' DESIRE TO REDUCE THEIR HEALTH CONCERNS.

3. DEVELOP PRODUCTS WHICH ADDRESS THE PUBLIC'S DESIRE TO REDUCE ENVIRONMENTAL TOBACCO SMOKE.

4. DEVELOP PRODUCTS WHICH WILL INCREASE OUR VOLUME AT THE EXPENSE OF OUR COMPETITORS TO GIVE US OUR "FAIR SHARE."

5. IDENTIFY NEW PRODUCT/PROCESS CONCEPTS AND DEVELOP PRODUCTS/PROCESSES FOR THE INTERNATIONAL MARKET.

6. PROVIDE A BROAD FOUNDATION OF BASIC RESEARCH THAT WILL GENERATE NEW PRODUCT CONCEPTS IN 5-15 YEARS.

These strategic goals were developed around two focal points: our current business and our future business. Generally, Goals 1, 4 and 5 focus on R&D support of our current business, while Goals 2, 3 and 6 focus on our future business and ability to meet the PM USA five year goals. The R&D programs, both current and planned, needed to address these goals are also outlined. Resource allocations essential to the implementation of the R&D Five Year Strategic Plan are provided for each R&D program for the five year period. Execution of the proposed programs will result in a significant R&D contribution to the realization of the PM USA goals.

The plan recommends an increase of 43 in the R&D headcount over the five year period. This increase is necessary both to carry out programs

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leading to new products which will fuel the growth of PM USA in the future, as well as for support of those new products which we anticipate introducing in the next two years.

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A. R&D MISSION STATEMENT

Philip Morris USA is in the tobacco products business and is the number one cigarette product company in the United States. Our continued success through growth and in profitability are dependent upon the recognition of the consumers' present and future wants and needs as well as the improvement of our competitive advantage in the industry. We must offer the consumer the highest quality, most satisfying flavor and most technolgically advanced tobacco products while striving to be the low cost industry producer.

To support the above Company mission, R&D has three main responsibilities:

1. **Our first responsibility is to protect our present product lines. The current market share must be protected. R&D will initiate new concepts and programs that will improve the existing products and processes of manufacturing which will result in continued brand loyalty, brand extensions and low cost production.**

2. **Our second responsibility is to develop new technology-driven products that will satisfy future customer wants and external requirements. These products will be in the areas of environmental smoke reductions, health concerns, unique flavors, reduced nicotine, fire safety, biological activity, and other innovative products which will capture new volume and market share of 50% by 1995.**

3. **Our third responsibility is to serve as the technology storehouse for the Corporation in order to accomplish the first two responsibilities.**

B. SITUATIONAL ANALYSIS

Situational Analysis is divided into two parts - internal and external. The internal analysis covers PM USA R&D and PM Europe R&D programs. External analysis covers competitors, social and political influences, suppliers, and technology assessment.

1. Internal Analysis

PM USA R&D

The 1989 PM USA R&D major programs were formulated at the December, 1988, R&D Quarterly Planning Conference. The following 13 major programs were approved for 1989 at that Conference:

1. Project ART

2. Project Sigma

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3. Domestic Product Support

4. International Product Support

5. Operations Support

6. Reduced Density Rod

7. Filtration Research

8. Paper Technology/Reduced Sidestream

9. Project Tomorrow

10. Optical Processing

11. Low Tar/High Flavor

12. Tobacco Specific Nitrosamines (TSNA)

13. Lowered Biological Activity (LBA)

One program which had been classified as "major" in 1988, Alternate Humectants, was placed under Operations Support for 1989. This program was nearing completion by the end of 1988, and the level of resources it would require during 1989 no longer justified its classification as a major program. The Reduced Sidestream program was broadened and retitled Paper Technology/Reduced Sidestream. In addition to Reduced Sidestream this program includes all aspects of cigarette paper R&D including portions of Project Sigma and Project Tomorrow as well as Project Ambrosia. One program was added during 1989; namely, Project PACT. Project PACT is a proactive program directed toward the development of efficient room air handling systems in order to minimize the effects of environmental tobacco smoke in public places. This program was added at the request of the Corporate Affairs Department.

In addition to the major programs, a percentage of the R&D staff is devoted to "other programs." These programs, which generally have only a few individuals assigned to each program, are of two types. The first type includes small projects which are necessary to support our current business, while the second type includes long-term research efforts which are anticipated to develop into major programs in the future. It is important to stress that these other programs are as important to the fulfillment of PM USA's R&D goals as are the major programs. **All of PM USA R&D's programs are designed to support the PM USA R&D Strategic Plan.**

A comparison of R&D program direct resource allocations for 1988 and 1989 as a percentage of R&D staff is given in Table 1. Also given in Table 1 are the predicted resource allocations for 1989 which were estimated in 1988. Directly allocated resources were used since they can be obtained

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TABLE 1

Comparison of Directly Allocated Resources, 1988 to 1989
(Percentage of R&D Staff)

	1988 (Actual) (%)	1989 (Actual) (%)	1989 (Est.) (%)
Project ART	10.4	14.3	10.3
Project Sigma	12.0	10.0	15.0
Domestic Product Support	13.8	12.1	9.8
International Product Support*	8.7	10.6	6.2
Operations Support	12.3	12.8	12.7
Reduced Density Rod	7.0	4.7	6.7
Filtration Research	2.2	3.1	3.2
Paper Tech./Reduced Sidestream	7.0	10.5	8.0
Project Tomorrow	1.3	1.1	2.6
Optical Processing	1.2	1.5	1.8
Low Tar/High Flavor	3.9	2.2	2.3
TSNA	3.1	5.2	4.6
LBA	2.9	3.2	3.6
Other Programs	13.5	8.7	13.0

*Includes QZ personnel

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more accurately. Inspection of Table 1 shows that there are two programs which have significantly more resources devoted to them in 1989 than in 1988. These two programs are Project ART and International Product Support. In retrospect these differences are not surprising. Preparing for the Project ART test market has required considerable R&D resources in order to address challenges involving both the process and the product. It should be noted that it is likely that considerable resources will continue to be devoted to Project ART for the next one to two years with respect to both process and product improvements. With respect to International Product Support, increasing international sales as well as new markets in the Far East have led to a significant increase in international product development. This trend is expected to continue for the next few years.

Significantly fewer resources than expected were allocated to Project Sigma and Other Programs. The withdrawal of Premier from the market place caused a change of emphasis in the Delta program. A decision was made to defer the introduction of Delta as an actual product and concentrate on research necessary to further improve it. The research and product development work now being pursued in this area was designated Project Sigma. Fewer resources were required to pursue this strategy. As far as Other Programs are concerned, the additional resources for Project ART and International Product Support coupled with the need to maintain the remaining major programs at the expected level forced a cutback.

Support was allocated to each program by each responsible manager based upon the best available information. In some cases, such as the Tobacco Processing Division (Semiworks), support was allocated to each major program based upon the percentage of requests from each major program. In other cases, such as the Computer Applications Division, support was allocated on a Divisional basis, and then reallocated by program based on the allocation for each Division. Table 2 shows the 1989 resource allocations for R&D programs giving direct resources, support and total resources.

Both Operations Support and Other Programs are composed of a number of small projects. Projects included under Operations Support are shown in Table 3 along with directly allocated resources. Projects included under Other Programs are shown in Table 4. It has already been pointed out that the number of resources allocated for Other Programs has decreased significantly in 1989. The two Divisions that have experienced the greatest decline in resources allocated to Other Programs are Analytical Research and Development Engineering. For both Divisions virtually all of the resources devoted to Other Programs in 1988 were devoted to Project ART in 1989. There was also a net decrease of 5.0 individuals in Biochemical Research brought about by the decision to include a Project designated as "Natural Products Research" in 1988 as part of Operations Support Program.

PM USA R&D has continued to work collaboratively with outside scientists both at universities and small high technology companies. The support of outside programs declined from 1988 and is expected to decrease somewhat further in 1990, although commitments for Project Beta could cause

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TABLE 2

Total Resource Allocations for PM USA R&D Programs
Calendar 1989
(Numbers of individuals[1])

	Direct	Support	Total	%
Project ART	60.45	21.35	81.80	14.5
Project Sigma/Beta	42.00	10.10	52.10	9.2
Domestic Product Support	50.95	20.65	71.60	12.7
International Prod. Support[2]	44.65	9.00	53.65	9.5
Operations Support	53.85	28.70	82.55	14.7
Reduced Density Rod	20.00	5.30	25.30	4.5
Filtration Research	13.15	3.60	16.75	3.0
Paper Tech./Red. Sidestream	44.45	15.05	59.50	10.6
Project Tomorrow	4.75	1.90	6.65	1.2
Optical Processing	6.30	1.40	7.70	1.4
Low Tar/High Flavor	9.45	3.15	12.60	2.2
TSNA	21.80	4.90	26.70	4.7
LBA	13.55	3.05	16.60	2.9
Other Programs	36.65	12.85	49.50	8.8
	422.00	141.00	563.00	99.9

1. Excludes 43 executive and administrative personnel

2. Includes QZ personnel

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TABLE 3

Distribution of Directly Allocated Resource Allocations for the Operations Support Program

	No. of Personnel	%
Semiworks Support	5.00	9.3
New Tobacco Processes	3.75	7.0
Tobacco Sheet Improvements	1.50	2.8
Burley Spray	1.00	1.8
Tobacco Microbiology	5.00	9.3
Entomology	4.00	7.4
Alternate Preservatives	5.00	9.3
Alternate Humectants	2.00	3.7
Materials Evaluation	2.00	3.7
Customer Complaints	1.00	1.8
ETS	6.00	11.1
Analytical Flavor Specifications	5.30	9.9
Support the Current Business	12.30	22.8
Total	53.85	99.9

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TABLE 4

Summary of Other Programs by Division

Division	Program	Resource Allocation
Flavor Development	Tobacco Flavor Investigations and Development	2.25
Cigarette Technology	New Product Concepts/New Packaging Concepts	1.05
	Tipping Paper Evaluations	0.60
	Lab Instrument Maintenance	0.10
	Large Scale Equipment Maintenance	0.50
Biochemical Research	Electrophysiological Studies	2.00
	Immunochemical Studies	1.50
Physical Research	Aerosol Research	2.25
	Menthol Research	1.75
Chemical Research	Flavor Research	4.40
	Separation Methods R&D	0.40
	Tamper Evident Packaging	0.10
	Cooperative Programs with Leaf Department	0.75
	MDL/MACCS Coordination	0.30
	Department Radiation Safety Officer	1.00
Development Engineering	C Pilot Plant Rebuild	1.25
Tobacco Fundamentals	Firmness while Smoking	1.00
Product Development	Special Projects	1.00

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TABLE 4 (Continued)

Division	Program	Resource Allocation
Tobacco Materials	Foam Bonded Ends	1.35
	Expanded Tobacco Technology and DIET	0.80
	Hauni HT Evaluation	0.85
	Stem Processing	1.35
	C Pilot Plant Rebuild	0.30
Computer Applications	Molecular Modelling	1.00
	Expert Systems	0.90
	Neural Networks	0.60
	Technology Assessment	0.30
Product Evaluation	Smoking Behavior	0.40
	Models of Human Perception	0.40
	Non-Menthol Mapping	0.20
Various		5.75
Total		36.65

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an increase. The collaborative research programs for 1989 as well as those budgeted for 1990 are summarized in Table 5.

During the period July 1, 1988, to July 1, 1989, PM USA R&D and PM USA Engineering have been active with respect to both patents and publications. A total of 9 US Patents and 18 European Patent Office Publications issued during this period. These patents cover a wide area ranging from flavor-release compounds to new cigarette making equipment. Twenty-seven publications appeared during this same period of time. The publications can be classified into five major areas; namely, sensory analysis, analytical chemistry, physical organic chemistry, biochemistry and radiochemistry.

PM Europe R&D

PM Europe R&D continues to expand the number of systems in place for monitoring cigarettes and key cigarette components. Most recently they have installed a system to monitor cigarette firmness exit the factory, and filter RTD's and diameters from each European factory. More importantly from a strategic planning point of view they are in the process of establishing a three way computer network with an appropriate data base involving R&D, marketing and manufacturing. This system, when complete, will allow each of these three Departments to respond rapidly to opportunities and challenges.

A mechanism has been established to allow more meaningful collaboration between PM Europe R&D and PM USA R&D. The key objectives of this collaboration are to: 1) discuss the applicability of PM USA R&D product development to PM Europe; 2) discuss the applicability of PM Europe product development to PM USA; and 3) identify specific areas of interest to PM Europe which require significant research. At this time the American and European markets are quite different, and there is little overlap in new product concepts. On the other hand, a number of areas have been identified wherein PM USA R&D can make a significant contribution through its research programs. The first of these is in the area of selective filtration, particularly with respect to carbon monoxide and nitrogen oxides. The second is the impact of cigarette and sidestream aroma on the subjective experience of smoking. This area complements work that is being initiated at PM USA R&D on Project Ambrosia, and close communication between key individuals in both USA and Europe will be maintained.

A copy of the PM Europe R&D Strategic Plan is included in Appendix A.

2. External Analysis

Competitive Analysis

We have expanded our competitive analysis to include Japan Tobacco Inc. (JTI) as well as RJR and BAT. Nothing in the past year has led us to alter our opinion that the other three domestic tobacco companies, American Brands, Lorillard and Liggett, do not represent a competitive challenge,

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TABLE 5

PM USA R&D Collaborative Research Programs

Program Description	Location	Budgeted Amount ($000) 1989	1990
Heat Sources/Combustion Modeling	NY Polytechnic	907.0	579.0
Project Delta/Sigma	Stone Products	100.0	70.0
Project Beta	Pinnacle Research	203.0	200.0
Project Beta	Motorola	200.0	200.0
Gustatory and Olfactory Research	Monell	32.0	0
Localization of Nicotine in Tobacco	Cambridge Univ.	55.1	8.5
Use of MS/MS	Univ. of Nebraska/ Univ. of Pittsburgh	3.0	0
Study of CO Sensors	VCU	13.2	0
Nornicotine Determinations	Cumberland Consulting Chemists, Inc.	8.9	0
Preparation of Nicotine Antibody	Litron Laboratories	19.9	26.5
Two Dimensional Gel Electrophoresis	PDI	20.0	9.5
cDNA Expression Library	Various	5.0	16.0
Protein Sequencing	Various	4.5	4.5
Pesticide Work	Tobacco Pesticide Group	4.0	0
Neutron Radiography	University of Va.	142.0	180.0
Sol-Gel Research	NY Polytechnic	135.0	135.0
Low Level Counting	Battelle NW	20.0	15.0

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TABLE 5

PM USA R&D Collaborative Research Programs
(Continued)

Program Description	Location	Budgeted Amount ($000) 1989	1990
Lumen Loading	Univ. of Washington	18.0	0
Sol-Gel Analysis	VPI	58.2	90.0
Paper Technology	Univ. of Maine	60.0	60.0
Menthol Release	Bayer A. G.	77.0	124.0
Custom Synthesis	VCU	0	18.0
X-Ray Crystallography	Oneida Labs	0	25.0
Cluster Formation (Aerosols)	Colorado State	109.5	112.0
Project Beta	Brandervision	12.0	0
Oxidation Catalysts	Seton Hall Univ.	127.9	76.1
Project Sigma	Procedyne	25.8	0
Optical Processing	Carnegie-Mellon	54.4	54.4
Dynamic Nuclear Polarization	Colorado State	47.6	0
Simulation of Liquids & Aerosols	VPI	38.7	57.0
Thermodynamic Properties of Supercritical Fluids	Georgia Tech.	12.0	12.5
Supercritical Extraction	Supercritical Proc. Inc.	49.6	16.0
Project ART Water Column	University of Texas	27.5	27.5
Project Sigma/Beta	Laser and Mechanical Systems	5.0	5.0

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TABLE 5

PM USA R&D Collaborative Research Programs
(Continued)

Program Description	Location	Budgeted Amount ($000) 1989	1990
Optical Processing	Unicorn Systems	1.2	0
Project Sigma Development	Stackpole Company	234.4	191.0
Circuit Design - Project Beta		0	10.0
Heater Design - Project Beta		0	60.0
Project Pact		0	12.6
Corrosion Research	Dupont Safety Mgmt.	15.0	0
ART Pilot Plant Design		9.9	0
Corrosion Studies	University of Va.	9.6	4.0
Carbon for Plug-Space-Plug Filter	Stackpole Company	55.0	0
R&D Computer Operations	Index Group	44.0	0
Engineering Services	Nolen, Friska Brooks	16.0	16.0
Emergency Response Team	FDM Safety Services	22.0	20.0
Contract Programming	Computer Horizons	50.0	0
Contract Programming	McKinney & Assoc.	29.0	0
Contract Programming	Fortex	25.0	0
Contract Programming	Various	0	7.5
Total		**3106.3**	**2442.6**

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despite the introduction of a new brand with a citrus odor in the sidestream from Lorillard. This conclusion can now be supported by hard information obtained from Schonfeld & Associates, a research organization based in Evanston, Illinois, on R&D budgets for these three companies. According to their data American had an R&D budget of $17.9 million, Lorillard a budget of $11.1 million and Liggett an R&D budget of $30.7 million. The Liggett number is somewhat surprising, particularly since it represents 13.7% of sales and 21.9% of margin. Nevertheless, the R&D resources for these three companies clearly preclude their ability to do much more than support current business or carry out short-term research at this time.

We have increased our effort in monitoring our competitors. We have requested that Departments outside of R&D, particularly Leaf, Purchasing and Employee Relations (Employment) provide us with any competitive information they may acquire. We are working with other PM Companies, particularly General Foods, to refine our competitive analysis effort. Also the senior scientific staff is monitoring competitor's patents and patent applications, where possible, on a quarterly basis in order to be able to identify potential new products and processes rapidly.

Competitive Analysis - RJR Tobacco

Highlights

The major highlights with regard to RJR Tobacco have been the withdrawal of Premier from the market place, the introduction of two new products, Vantage Excel and Chelsea, the willingness of RJR's new management to compromise quality in order to reduce costs, and the recently announced layoffs.

In February, 1989, RJR announced that they were withdrawing Premier from test market. There were three clear reasons for this decision. The first was the extremely poor performance of the product in the market place. The second was Kohlberg, Kravis and Roberts' (KKR) need to cut expenditures in order to meet debt payments. The last was the continued and violent opposition of anti-smoking groups. Despite the withdrawal of the product, however, the evidence indicates that RJR continues to work on Premier. We obtained information that RJR Tobacco might be working in conjunction with Mitsubishi Corporation on Premier. Further research revealed that Reynolds and Mitsubishi established a joint venture for cigarette sales, promotion and merchandising in Japan in 1984, and that cooperative efforts between the two companies predates the joint venture. However, there seems to be no firm evidence that they are working together on Premier. A full report on Mitsubishi Corporation, including information on its joint venture with RJR Tobacco, is included as Appendix B.

In December, 1988, Reynolds introduced a low sidestream product, Vantage Excel, in three test markets - New Orleans, Little Rock, and Detroit. This product was advertised as being lower in smoke than the leading 100 mm light cigarette. The technology used to achieve the decrease

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in visible smoke was the use of a low sidestream cigarette wrapper containing magnesium hydroxide developed by Ecusta. Vantage Excel has significant subjective problems with regard to both taste and ash appearance quite characteristic of cigarettes made with magnesium hydroxide wrappers. Although the product remains in test market, sales and consumer acceptance of the product have been low.

In April, 1989, Reynolds introduced Chelsea as "the first cigarette that smells good" into three test markets, Southern Florida, Eastern Pennsylvania, and Nevada. Chelsea utilizes paper coated with a compound which releases a vanilla aroma into the sidestream smoke. The compound itself is not novel, and the use of this compound to modify sidestream aroma by coating it on to cigarette paper was patented by Ecusta in February, 1989. RJR has exclusive use of the two compounds patented by Ecusta which result in a vanilla aroma. Although we have not been able to obtain any good quantitative data on the performance of Chelsea in the test market cities, indications are that it is not doing well.

Reynolds has recently taken two steps to cut costs which may adversely affect the quality of their products. The more important step is that they have reduced the weight of tobacco in all of their brands by an average of about 4-5%. This will of course reduce cigarette firmness. Secondly, they are now using a part wood pulp paper for their value priced and generic brands. It is not clear at this time whether this change will have any discernable effect on product quality.

On August 11, 1989, Reynolds Tobacco announced the elimination of 1525 full-time jobs, about 13% of their work force. This action was announced to be a consequence of a $300 million loss during the second quarter. This cut in personnel will affect 825 office workers and 700 factory workers. The company has not disclosed which departments will be affected. However, the Wall Street Journal reported that there would be fewer than 100 people released from R&D while the Greensboro News & Record indicated that the 50 person engineering staff has been cut in half. The Wall Street Journal also pointed out that the cut in R&D was approximately half of what was expected. We have heard various estimates from a number of sources regarding the number of cuts at R&D. However, the most reliable information indicates that approximately eighty individuals have been released from R&D, most of whom are either young Ph.D.'s or technicians.

R&D Organization

The 1988 PM USA R&D Strategic Plan indicated that the RJR Tobacco R&D staff consisted of 736 individuals, 408 of which were professionals and 328, technicians and support personnel. More recent information indicates that the total staff was between 800 and 850 before the cuts.

Information on RJR Tobacco's R&D budget has always been difficult to obtain, and will be more difficult to obtain now since RJR is no longer a publicly held company. Schonfeld & Associates lists budget data for RJR

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through 1988. The R&D budget quoted for RJR Nabisco in 1988 was $469.0 million; however, data are not given for individual operating units. If the assumption is made that the ratio of RJR to Nabisco was the same after the merger as before (about 1:4), then RJR Tobacco's R&D budget would have been $93.8 million in 1988. It is likely that this is a conservative estimate.

We have continued to expand our organizational charts for the RJR Tobacco R&D Center. These charts which list approximately 60% of their R&D professionals are shown in Appendix C. Their R&D Center is divided into four Departments, each headed by a Vice President who reports to Bob DiMarco, Senior Vice President of R&D. The four Vice Presidents are A. W. Hayes, Vice President of Biological R&D; M. E. Stowe, Vice President of Product & Applied Technology; R. A. Lloyd, Vice President of New Product Technologies; and W. M. Hildebolt, Vice President of Administrative & Technical Services. Biological R&D is divided into two Directorates, Biobehavioral & Sensory Evaluation and Toxicology Research. Biobehavioral & Sensory Evaluation encompasses three Divisions - Environmental Tobacco Smoke, Sensory Evaluation, and Biobehavioral Research; while Toxicology Research consists of two Divisions - Toxicology Research and Biochemistry/ Microbiology. Product & Applied Technology is divided into three Directorates, Brands Technology, Brands R&D and Basic Research. Brands Technology consists of two Divisions - Product Design Technology and Flavor Technology; Brands R&D is divided into three Divisions - Tobacco Standards, Brands R&D and Statistics; while Basic Research includes three Divisions - Analytical Chemistry, Aerosol Research and Chemical Research. New Product Technologies is divided into two Directorates, Product Technology & Development and Process Technology & Development. Product Technology & Development encompasses four Divisions - Mechanical Fabrication, Packaging Engineering, Materials Development, and Development; while Process Technology & Development also consists of four Divisions - Process R&D, Manufacturing Process Engineering, Process Development and Process Engineering. Lastly, Administrative & Technical Services is divided into two Directorates, Administrative Services & Agricultural Science and Technical Services. Administrative Services & Agricultural Science is divided into three Divisions - Safety/Maintenance Engineering, Agronomy, and Entomology; and Technical Services also includes three Divisions - Scientific Information, Statistics Support and R&D Planning. Also included in Appendix C is a description of the RJR Tobacco R&D dual ladder system.

Two changes at RJR Tobacco deserve special mention. The first is that the company announced that they have revamped its marketing department to establish "new brand team assignments [that] will integrate the efforts of brand marketing with support departments." Each team will include a marketing-information specialist, a finance manager, a sales planning manager, a research and development specialist, a manufacturing specialist and an engineering specialist. Inclusion of R&D personnel on each brand "team" may increase the effectiveness of the R&D/Marketing interface and increase the effectiveness of R&D at RJR Tobacco.

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The second change involves the recent addition of an individual to the RJR Tobacco R&D staff to head a competitive analysis and planning group. We have heard that the individual taking this position is a former CIA employee. A recent attempt made by RJR to acquire information about carbons being manufactured by the Stackpole Carbon Co. for PM would tend to confirm this rumor.

Patents and Publications

RJR Tobacco continues to patent aggressively. During the twelve month period between July, 1988, and July, 1989, twenty-seven US patents issued and fifteen European Patent Office applications were published. By far the largest category (40%) was related to Premier. The remainder fall into a large number of categories. There are only two patents which disclose potential new products. One of these (US 4,765,347) teaches a type of non-burning article; however, the technology used would be extremely difficult to execute, and it is unlikely that a workable product would result. The second (US 4,776,354) deals with a short cigarette which through giving fewer puffs achieves the goal of a "low tar cigarette" with increased tar per puff. Neither the idea nor the teachings in the patent appear novel. It is interesting that only one patent (US 4,821,747) and one European Patent Application (EPO 286,423) deal with new methods for expanding tobacco. The complete list of patents divided into subjects is shown in Table 6.

Only four of these patents deal with technology that is both new to and might be useful to PM. Three of these (US 4,768,526, US 4,770,193, and EPO 295,518) deal with novel methods of applying flavors to cigarette filters. The last (US 4,807,745) discloses a water impervious polymer laminate packaging material which is useful for cigarettes and other smoking articles. [A more recent European Patent Office Publication (300,734) describes an optical inspection system for cigarette packages which is state-of-the-art.]

One last note regarding the patents issued by RJR during the past twelve months is that one of these patents, a patent dealing with an improvement in their freon expanded tobacco process (US 4,821,747), was patented by two inventors both of whom reside in West Germany. This is the first clear evidence we have seen regarding an international R&D effort from RJR Tobacco.

Based on the number of publications and presentations (excluding TCRC presentations) from July, 1988, to July, 1989, publishing activity at RJR Tobacco is declining. During this period there were only 13 publications and presentations, none of which is dated any later than April, 1989. Eleven of these publications are in three categories; namely, flavor chemistry (5 publications), analytical chemistry (4 publications), and toxicology (2 publications). The remaining two papers are on ETS and behavioral research.

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TABLE 6

RJR Tobacco Patents from July, 1988, to July, 1989

Premier Related Patents
US Patents - 6
EPO Publications - 11

Reconstituted Tobacco
US Patents - 4

Expanded Tobacco
US Patents - 1
EPO Publications - 1

Dual Rod
US Patents - 1

"Ripper Shorts" Methodology
US Patents - 1

Sensory Evaluation
US Patents - 1

ETS Monitoring Device
US Patents - 1

Low Sidestream Cigarette
EPO Publications - 1

Addition of Flavors to Filters
US Patents - 2
EPO Publications - 1

Packaging
US Patents - 2

Adjustment of Nicotine Level
US Patents - 2

Tax Stamp Machine
US Patents - 1

Nonburning Article
US Patents - 1

Short Cigarette
US Patents - 1

Variable Dilution Filter
US Patents - 1

Optical Inspection
EPO Publications - 1

Computer Integrated Manufacturing System
US Patents - 1

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Board of Directors

As would be expected, the RJR Nabisco Board of Directors has changed considerably after the KKR takeover. The original base Board of Directors formed after the takeover consisted of Henry R. Kravis, Paul E. Raether, R. Theodore Ammon, Clifton S. Robbins, and Scott M. Stuart, all of KKR, and J. Paul Sticht, former Chairman and CEO, RJR Nabisco. Louis V. Gerstner, Jr., was added to the Board when he was named Chairman and CEO. Later additions to the Board were Karl von der Heyden, Executive Vice President and Chief Financial Officer, RJR Nabisco; Vernon E. Jordan, Jr., law partner in Akin, Gump, Strauss, Hauer and Feld; John G. Medlin, Jr., Chairman and CEO, First Wachovia Corp.; H. John Greeniaus, President and CEO, Nabisco Brands; James W. Johnston, President and CEO, RJR Tobacco, USA; and Rozanne L. Ridgway, President-Elect, Atlantic Council of the United States. Only J. Paul Sticht, Vernon E. Jordan, Jr., and John G. Medlin, Jr., are former members of the RJR Nabisco Board of Directors before the KKR takeover. It is interesting to note that those individuals with connections with high technology companies previously on the RJR Nabisco Board are no longer on the Board.

Strengths and Weaknesses

An analysis of the technical capability of the RJR R&D center through its publications and patents indicate that there have been few changes from the previous year. Based upon the meager number of true product patents, it would seem inappropriate to list product development as a RJR R&D strength. This conclusion is also corroborated by the, at best, incomplete product development work done by RJR Tobacco R&D on their two most recent products. Consequently, it has been deleted. On the other hand there is one weakness that no longer appears on the list; namely, computerization. RJR Tobacco has been extremely active during the last year acquiring in-house computer skills. Their increasing strength in the area of computerization is most likely an outgrowth of the development of a fully integrated computerized manufacturing system installed in Tobaccoville. The lists appear below.

Strengths

a. Analytical chemistry - RJR Tobacco R&D continues to demonstrate through publications high quality research in the area of state-of-the-art-instrumental analysis.

b. Toxicology - The published toxicological research on the condensate from Premier demonstrated that RJR Tobacco has a large, highly qualified toxicology research group. The work was outstanding.

c. Electrophysiology - The electrophysiology group appears to be remaining active. Three presentations were given at the Tenth Annual Meeting of the Association for Chemoreception

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Sciences, including one on the psychophysical and psycophysiological response to sidestream cigarette smoke.

d. Process development - Novel process development continues at RJR. The best example, as already mentioned, is their work on novel methods of introducing flavors into cigarette filters.

e. Extensive university and outside industrial contacts - Up until recently RJR has maintained their outside contacts discussed in last year's plan. There are signs, however, that these contacts may be reduced in the near future in order to cut costs. A contract with VPI&SU has already been eliminated, and it appears that collaborative work with Baylor University on nicotine antibodies will be terminated at the end of 1989.

Weaknesses

a. Organic and inorganic chemistry - RJR Tobacco R&D continues to depend primarily on outside expertise for basic organic and inorganic chemical research.

b. Physics - With the exception of an aerosol research group, there is no evidence of physical research being carried out at RJR Tobacco R&D. As was pointed out in last year's plan, this lack explains their dependence on outside university and industrial contacts to do the necessary work on Premier.

c. Materials science - There is still no evidence that any research in this area is being carried out at RJR Tobacco. However, we were informed that an individual in the Process Technology and Development Division attended a recent meeting of the American Ceramic Society. This individual's main interests appeared to involve filtration and analyses of certain clay products.

d. Natural products chemistry - As was the case last year, there were no publications from RJR Tobacco R&D dealing with this topic.

RJR Tobacco International

RJR Nabisco announced in mid July that the headquarters of R.J. Reynolds Tobacco International would be moved back to Winston-Salem. About twelve senior executives will relocate to Winston-Salem joining 135 people on the Tobacco International staff already there. RJR Tobacco has reorganized its worldwide business into three regional units, each headed by a president, who will report to Dale F. Sisel, the chief executive of Tobacco International. These three individuals are K. D. Langner, who will

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become regional president for Europe, the Middle East, and Africa and will be based in London; E. J. Lang, who will become regional president of the Americas region including the Caribbean, Latin America, and Canada and will be based in Toronto; and J. H. Sherrill, Jr., who will become the president of the Asia-Pacific region and will be based in Hong Kong.

We have also obtained information indicating that RJR Tobacco International has three small R&D labs located in Trier, West Germany, Montreal, Canada, and Brazil. With the exception of the patent already discussed, there have been neither patents nor publications from any of these laboratories. We have recently been informed that the Trier laboratory has been shut down.

Competitive Analysis - Brown and Williamson

Highlights

As was the case with RJR Nabisco last year, it is possible that BAT, B&W's parent organization, will go private through a leveraged buy out initiated by Sir James Goldsmith. On August 8, 1989, Sir James announced a bid of $21.4 billion for BAT. There is a major difference, however, between the two situations. The proposed LBO for RJR Nabisco was initiated by management. Therefore, the question was not whether RJR Nabisco would be bought out, but rather who would buy them out. In the case of BAT, the LBO was initiated by an outsider, and BAT's management has vigorously fought the attempt. They have been successful to date. Consequently, it is quite possible that the LBO will not succeed. However, it is likely that a second bid for BAT's shares will be forthcoming. One thing that is fairly certain is that if Sir James does succeed, he may break the company up and sell off all of the divisions except the tobacco business.

R&D Organization

It is considerably more difficult to obtain information regarding the B&W R&D orgnization compared to RJR. However, we are aware of a number of changes which have taken place. A new Vice President of R&D has been named, JS Wigand. He has no previous experience in the tobacco industry, but instread has a background in the pharmaceutical industry. Lance Reynolds is no longer Director of Exploratory Research, and is now Director of Research. The former Exploratory Research group now reports to him, and is titled New Technologies. Information indicates that this group may be involved in research on new products such as Delta. Lastly, the Engineering Group has been split off from R&D and has been moved to Macon, Georgia. The B&W R&D organization chart is given in Appendix D.

Even further change is likely in the future. B&W placed an advertisement in the August 7, 1989, edition of Chemical and Engineering News for six new scientists. Three of the positions, two for analytical chemists and one for a product development chemist, were for individuals with skills which would simply augment B&W's existing staff. The other three positions,

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however, indicate that B&W plans to branch out into two areas. One position was for a Ph.D. biochemist to take the position of Section Head - Biotechnology. The position description requires that the individual "manage internal and external programs in biotechnology, focusing on the development of new tobacco varieties or the generation of modified tobaccos." A second position was for a Ph.D. Biochemist who would clearly be a member of this new Section. The last position was for a Ph.D. Physical Chemist/Materials Scientist who would "provide the scientific base to develop leading edge technologies for new products." The position requires experience in heat and mass transport and surface properties of materials. B&W's current plans clearly are to develop novel, high-tech products for the cigarette market.

Patents and Publications

Brown and Williamson continues to be extremely active with respect to patenting. From the twelve month period of July, 1988, to July, 1989, they have eight issued US patents. This is supplemented, however, with six US patents and nine European Patent Office Publications from BAT, UK, and five US patents and seventeen European Patent Office Publications from BAT Cigarettenfabriken, GmbH, West Germany, for a total of of nineteen US Patents and twenty-six European Patent Office Publications. The majority of this patent activity (73%) is in four areas; namely, QA inspection devices (24%), manufacturing equipment (20%), packaging (16%), and tobacco expansion (13%). The complete breakdown of BAT patents is given in Table 7. Only six of the patents and patent office publications deal with potential products. Three (EPO 209,267, EPO 209,268 and EPO 209,269 from BAT, UK) disclose wrappers for low sidestream cigarettes. No novel technology is disclosed in these patents. The other three disclose a concentric cigarette rod similar to the rod used in Project Abstract (DE 3,743,597 from BAT GmbH), a non-burning article using technology which will undoubtedly not function well (US 4,765,348 from B&W), and a grooved cigarette rod most probably to control mass burn rate (US 4,825,885 from B&W).

Only two BAT patents cover technology in which PM USA might be interested. One (US 4,760,854 from B&W) teaches a method for tobacco expansion at a low moisture level. The other (US 4,823,817 from BAT, UK) describes a potentially useful process for tobacco reconstitution which extrudes a mixture of tobacco, starch, a binder and water followed by a draw down step and cutting to particle size.

The large number of patents and published patent applications involving QA inspection devices is intriguing. It would appear that BAT may have adopted the strategy of improving their competitive position through improvement of product quality. The fact that all of this activity has been in the UK and West Germany, however, may indicate that this strategy is a European rather than a US strategy.

With the exception of a few TCRC presentations no publications or presentations have issued from B&W R&D during the twelve month period from

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TABLE 7

BAT Patents from July, 1988, to July, 1989

QA Inspection Devices
- BAT UK - 2
- BAT GmbH - 9

Packaging
- B&W - 4
- BAT UK - 2
- BAT GmbH - 1

Low Sidestream Cigarettes
- BAT UK - 3

Tobacco Flavors
- B&W - 1
- BAT GmbH - 1

Mass Burn Rate Control
- B&W - 1

Concentric Cigarette Rod
- BAT GmbH - 1

Manufacturing Equipment
- BAT UK - 1
- BAT GmbH - 8

Tobacco Expansion
- B&W - 1
- BAT UK - 3
- BAT GmbH - 2

Filter Technology
- BAT UK - 2

Non-Burning Article
- B&W - 1

Tipping Paper
- BAT UK - 1

Reconstituted Tobacco
- BAT UK - 1

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July, 1988, to July, 1989. Over this same period of time only one publication has been issued by BAT scientists, a paper dealing with aerosol physics from BAT Cigarettenfabrik, GmbH.

Strengths and Weaknesses

Brown & Williamson has an excellent research center which has previously demonstrated its ability to generate new products and processes. Although it is half the size and has about half the budget of the PM USA Research Center, B&W appears to be expanding its R&D facility, and it still has considerable resources to draw on abroad. The number of patents and patent applications in twelve months exceeds the amount generated by RJR Tobacco. In summary, B&W should be regarded as a serious competitor.

Competitive Analysis - Japan Tobacco

R&D Organization

Japan Tobacco (JTI) has a large R&D facility of, as of yet, indeterminate size. The majority of the laboratories are located in Yokohama, and are divided into three separate organizations - JTI Central Research Laboratory, JTI Tobacco Science Laboratory, and JTI Life Sciences Laboratory. In addition each separate R&D organization has a number of experimental stations in other areas of Japan. The organization chart for the Central Research Laboratory is shown in Appendix E. It consists of about 300 individuals. Groups are designated by general terms, and we have been unable to determine the functions of most of these groups by matching names taken from patents and publications for three reasons: 1) most of the patents are from engineering groups which are not part of the Central Research Laboratory; 2) only a relatively small percentage of the publications are solely from the Central Research Laboratory; and 3) a number of publications have only one or two authors from JTI, the rest being from universities. The only group we were able to identify in this manner was the organic chemistry group. We have no information at this time regarding either of the other two laboratories.

Our information regarding JTI's R&D budget is that it is $400 million. This number appears to be quite high, but it has been checked several times. However, as was pointed out above, since we do not know the total size of JTI's R&D staff, we do not know if a $400 million R&D budget is actually out of line. Moreover, we also know that JTI supports some sophisticated outside research, particularly in the biotechnology area, which undoubtedly requires significant funding. Their commitment to biotechnology is supported by the fact that JTI recently completed its purchase of a Belgian biotechnology company, Plant Genetic Systems, for approximately $60 million, and is planning to diversify into international food production.

Patents and Publications

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JTI has been quite active with respect to both patents and publications. They have generated 15 US patents and 13 European Patent Office Publications during the twelve month period between July, 1988, and July, 1989. Over half of these (61%) are in one area, manufacturing technology. Clearly JTI appears to be pursuing a strategy of cost reduction and improved quality in order to increase their competitive advantage. There were no new product patents during this period, although there were two patents dealing with filter technology. A complete list of JTI's patents is given in Table 8.

JTI has been as aggressive with respect to publishing as it has with respect to patenting in the same twelve month period. During this period JTI R&D issued 24 publications. Almost half of these (46%) dealt with biotechnology including genetic engineering, cell culture, microbiology and enzymology. The remainder, however, were distributed over a wide range of disciplines including synthetic organic chemistry, inorganic chemistry, natural products research, engineering, computers, toxicology and fermentation science. It should be pointed out that all of these publications appear to be of extremely high quality.

Strengths and Weaknesses

Based upon an analysis of their patents and publications, JTI possesses an extremely competent R&D center that does work of the highest quality. It is safe to say that if US Companies have been successful in competing with JTI, it is not due to an advantage in technology. The JTI research center has considerable demonstrated strengths in biotechnology, organic chemistry, inorganic chemistry, computers, engineering, and process development. If there are any weaknesses, they are not obvious. They do seem to be using their technological expertise, however, to pursue a strategy of technology-driven diversification rather than attempting to obtain a competitive advantage over foreign cigarette companies. This decision is not surprising given the fact that the Japanese tend to adopt much longer-range strategies than do American companies.

Competitive Analysis - Other Tobacco Companies

In March, 1989, P. Lorillard introduced Spring in three test markets, Hartford, Conn., Milwaukee, Wis., and Arizona. The cigarette was novel in that both mainstream and sidestream had a lemon (citrus) flavor. The technology was described in a recent US Patent (US 4,823,059, May 23, 1989). We have very limited information on this product. Apparently retailers in Milwaukee are returning products, and there was no evidence of movement of the product in June. What makes this new product noteworthy, however, is the fact that it is the first evidence in quite some time of any new product activity at Lorillard.

Competitive Analysis - Non-Tobacco Companies

Philip Morris USA faces competitive challenges outside of the

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TABLE 8

JTI Patents from July, 1988, to July, 1989

Manufacturing Equipment
- US Patents - 10
- EPO Publications - 7

Filter Technology
- EPO Publications - 2

QA Inspection Devices
- EPO Publications - 1

Tobacco Picker and Sorter
- US Patents - 1

Synthetic Organic Chemistry
- US Patents - 2
- EPO Publications - 2

Tobacco Expansion
- EPO Publications - 1

Reconstituted Tobacco
- US Patents - 1

Entomology
- US Patents - 1

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cigarette business; namely, from companies developing various types of smoking cessation aids. In 1987 the "chemical deterrents to smoking" business was estimated to be a $100 million business and was expected to quintuple in the following few years. Although these sales figures are small compared to the domestic cigarette business, they certainly cannot be ignored. Lakeside Pharmaceuticals, the company which markets Nicorette, announced in June, 1989, that they were starting up its "first-ever brand-name consumer campaign" for Nicorette. This move was in response to Advantage Health & Fitness Products' announcement that they would be marketing a Cigarest chewing gum, a non prescription product. Three companies are working on transdermal nicotine patches - Ciba-Geigy, Warner Lambert and Cygnus Research. It is estimated that FDA approval of at least one of these nicotine patches could be forthcoming in two to three years. Lastly, two drugs have been identified, clonidine and prozac, which are claimed to be useful as adjuncts in smoking cessation programs.

We will continue to monitor the developments in this area. However, at present we have no programs in place to meet the growing threats of chemical deterrents to smoking. A program, or programs, may have to be formulated in the near future.

In addition interest in penetration of the profitable cigarette business may generate competition from areas where we least expect it. As was mentioned in last year's plan, Procter and Gamble issued a patent describing a battery "powered" cigarette. This year the University of California at Berkeley issued a patent describing a method of smoking cigarette smoke condensate thereby eliminating any possible adverse effects from gas phase. Neither of these patents represent a threat to the tobacco industry at present. However, they do indicate that a development which may be a threat could emerge from an unexpected source. As a consequence our vigilance should not be restricted to our "known" competitors.

Social and Political Influences

Social and political factors continue to be the greatest challenges to the industry. The major concern in this area is the anti-smoking movement. The current emphasis of the movement appears to be focused on environmental tobacco smoke (ETS) and the non-smoker as well as the social costs of smoking. Using the 1986 Surgeon General's report on ETS and the 1988 report on nicotine addiction as the backbone of their claims, anti-smoking forces are attempting to put pressure on smokers to make smoking unacceptable in any social situation including the home.

Additional strategies of antismoking groups include banning cigarette promotion and advertising, and increasing taxation to make cigarettes more expensive. Regulations imposing product requirements such as those relating to fire-safe cigarettes and ingredient labelling are areas in which action is anticipated within the plan period. Thus, the next five years will clearly be among the most challenging the industry has faced on the social and political fronts.

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A summary of 1988 legislative action and additional information on the 1988 state and local legislative year, California's Proposition 65, litter control, recycling and solid waste legislation are included in the three copies of "StateLine" found in Appendix F. A "Nonsmoking Ordinance Guide" published by the Texas Department of Health, Office of Smoking and Health, and American Lung Association of Texas is also included in Appendix F. This document describes in detail a guide which communities can follow to develop local ordinances designed to limit smoking in public places.

Suppliers

PM USA R&D must interact with a number of outside companies which supply components on which product or process development efforts depend. Examples are suppliers of cigarette paper, filter tow, adhesives, and tobacco flavors. We have established two strategic objectives with respect to these suppliers. The first is to be able to set meaningful specifications for each of the products we receive from our suppliers, and to ensure that these specifications are met. The second is to work with suppliers to design modified components for new cigarette products in such a way that PM can obtain exclusive use of these components for some period of time. In 1989 we continued to move closer to meeting these two objectives.

Flavor Suppliers

At the PM USA R&D planning meeting in December, 1986, it was determined that R&D should know and be responsible for the exact composition of each and every PM flavor and casing material. The initial step was to begin establishing confidentiality agreements with the vendors in order to obtain qualitative information as well as quantitative information by ranges. This phase has now been completed with all of the major vendors. These vendors provide 80% of our flavor ingredients both in terms of dollars and volume. The second step was to subject each flavor supplied by the major vendors to a thorough quantitative and qualitative analysis to ensure that each flavor formulation met our specifications. At this time about 50% of this work has been completed. It is estimated that it will require 18 months to complete this phase. This phase has taken considerably longer than expected since a great deal of the work had to be repeated as a consequence of revisions to the Ingredients List.

Filter Tow Suppliers

Our two filter tow suppliers, Celanese and Eastman, are currently working on a number of joint R&D programs in conjunction with PM USA R&D. The major effort at Celanese involves CA web, a high efficiency CA filtration medium which is comparable to paper in removal efficiency, but has better subjective character than paper. Currently, Celanese is working with two paper manufacturers to develop both a product and a process on a commercial scale. They are also developing technology to process the web into usable filter rods, and they have offered to share this technology with us. Two programs are being currently pursued with Eastman. We have

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successfully negotiated an exclusivity agreement on a filter which will reduce menthol migration with Eastman. As the first part of this work they will explore the effects of heat stress, aging, and plasticizer on menthol delivery. In addition we are working with Eastman on high efficiency tows.

Paper Suppliers

We have been working with Kimberly-Clark for most of 1989 with the goal of improving their responsiveness to our requests and obtaining exclusivity on jointly developed cigarette papers. At present virtually all of our work with KC involves wrappers for low sidestream cigarettes. We have obtained exclusivity on the outer wrap for Trim V as well as exclusivity on a "high basis weight" low sidestream paper which will be jointly developed. In addition we have secrecy agreements in place with Kimberly-Clark covering coating of flavor-release materials on to cigarette paper, bilayer sheets to reduce cigarette spotting, papers with improved runability for high speed manufacturing, and papers for control of mass burn rate.

We have started to work closely with Ecusta only recently. In August we agreed to jointly develop a low sidestream wrapper utilizing magnesium carbonate with an agreement to obtain exclusive use of any such wrapper if we desire. We also have secrecy agreements in place with Ecusta covering coating of flavor-release materials on to cigarette paper, the use of calendered bands to control mass burn rate, coating of paper with hydrophobic materials in order to reduce spotting, and the <u>in situ</u> precipitation of calcium carbonate in cigarette paper.

Adhesive Suppliers

There are four major suppliers of cigarette construction and packaging adhesives - National, Fuller, Findley, and Ajax - and two minor suppliers. National Starch and Chemical Corporation is owned by Unilever. Their products include adhesives, sealants, resins, chemicals, starches and food products. With sales of $1.4 billion in 1988 and producing 70% of their own raw material needs, National is the largest and most vertically integrated of our adhesive suppliers. Their investment of approximately 5% of sales into R&D supports a Research Center staffed by 600 individuals. Their leading position among adhesive vendors in R&D is also supported by their sizable patent estate of over 1000. National has recently entered into a confidentiality agreement with PM related to disclosure of adhesive ingredients.

H. B. Fuller Company produces adhesives, sealants, coatings, paints, sanitation chemicals, and specialty waxes. Like National, Fuller does manufacture its own polymers, but is not as vertically integrated. Whereas their sales ($685 million) and R&D resources (2% of sales) are significantly less than those of National, they are nonetheless a significant adhesive manufacturer and PM's major supplier.

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Findley Adhesives, Inc., manufactures adhesives, coatings, bone foam (meat packing), and gasket materials. Findley purchases its raw materials from other sources, and is a much smaller company than National or Fuller with sales of $125 million in 1988. Findley has exhibited excellent service, and is cooperative in addressing product modifications. They also serve as a distributor for Eastman Chemical's hot melt adhesives.

Ajax Adhesives Industries, Inc., produces adhesives and tobacco preservatives. They are a small privately-held company with sales of $20 million.

All of the above vendors also supply other operating companies within PM Companies, and many also supply some of PM USA's major competitors.

Collaboration with adhesive suppliers has just begun in 1989. As mentioned above, PM has recently signed a confidentiality agreement with National Starch, and intends to initiate work on setting adhesive specifications. In addition we are working with National on a collaborative program to develop a sideseam adhesive which will contain flavor-release compounds for Project Ambrosia.

Other Suppliers

Vision Systems

Because the field is new, vendors of vision systems (computerized devices which inspect product for visible defects) are generally small companies with limited resources. PM Engineering has worked extensively with one company (Itran) and more briefly with others. These companies are generally very interested in tobacco industry business and are responsive to our specialized needs (speed, resolution, interfacing).

R&D has recently developed a proprietary inspection procedure which allows global inspection of packs and shows promise for cigarette inspection. This development has been discussed with Itran. They have been reluctant to develop, package or maintain this system for us, however, since we would require control of its sale to others. Itran evidently feels that such potential restriction of their sales makes development at their expense impractical. Development on a fee basis was discussed, but a satisfactory agreement on price and (particularly) delivery time could not be reached. Solutions presently under consideration include the establishment of an "in-house" optical inspection function and/or the contracting of the assembly and maintenance of such systems to a third party "fabricator."

Infrared Monitors

The tobacco industry makes extensive use of infrared meters for on-line monitoring of tobacco moisture. New commercial instruments are evaluated in our facilities, and a commercial nicotine monitor is under evaluation in Process Development. These measurements are fairly "generic,"

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so that there has been no reason to ask the vendors to develop special apparatus for PM use. Since our industry is one of their major customers, the vendors are extremely responsive to our needs. However, their interest in proprietary developments would need to be determined when the occasion arises.

Technology Assessment

The objectives of the R&D Technology Assessment effort are to define needs for technology over the next five or more years; identify technology solutions; develop and/or adapt these solutions to our needs; and recommend and facilitate implementation of the technology. In 1988 twenty-five key emerging technologies were identified and discussed. These twenty-five technologies, and the status of these technologies at R&D, were discussed in detail in last year's R&D Strategic Plan. Three "strategic technologies" were selected for particular emphasis during 1989. These strategic technologies are: 1) optical inspection, 2) artificial intelligence, and 3) paper/adhesive/ink technologies.

Considerable progress has been made in the area of optical inspection of packs. PM USA Engineering has adapted commercial vision systems for use in several critical manufacturing locations. PM USA R&D has developed two proprietary systems. One, which utilizes a digital filter to perform "global" (as opposed to specific defect) inspection, will be evaluated at Stockton Street in November. The other is a less precise, but potentially fast and inexpensive system developed through contract research at Carnegie Mellon University.

A major challenge in implementing optical inspection systems is a need to minimize continuing support commitments. The question as to where PM-developed devices will be manufactured is also unanswered. This latter problem derives from PM's desire to have exclusive use of new technologies for some period of time. As of yet, no outside company is interested in manufacturing inspection equipment for PM only at a reasonable cost and in a timely manner.

Work continues to develop equipment for high speed cigarette inspection. PM USA Engineering is adapting some promising commercial technology, while PM USA R&D develops high speed (electro-optic) scanning techniques and new approaches to global inspection. To implement this technology there is a need to establish communication channels in order to identify critical applications and benefits, ensure practical approaches, and facilitate implementation.

Areas of optical inspection for off-line application include a tax stamp inspector, package blank inspection, and inspection of printed matter on the printing press. QA trials for the tax stamp inspector are in progress.

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Work in the area of artificial intelligence can be divided into two areas - advisory systems and process control systems. A cigarette design advisory system is now in use at R&D. Given construction parameters, it predicts cigarette performance. Ultimately, we would like to specify cigarette performance and have the system recommend optimum construction parameters. Work toward such a system is underway. This will be developed first as a filter design system and then extended to the entire cigarette. A cigarette information expert system is now being used in the Cigarette Testing Division. Continuing development work is ongoing for this system. The Computer Applications and Analytical Research Divisions are looking into the development of two systems, one for chemometrics, and an analytical chemistry advisory system.

Two process control systems for the ART process are under development. The first, an operator advisor, is being worked on by Engineering. The second is an expert system process simulation model which is being developed by R&D. Eventually, these two systems can be synthesized leading to on-line control for the ART process.

In addition to the work described above the R&D Computer Applications Division has initiated work on neural networks. Neural networks are networks of many simple processors which function in parallel. They have the capability of carrying out correlation, mapping and recognition from incomplete, complex or approximate information. A system to make smoker preference predictions from demographic data is under development.

In late 1988 a Paper Technology Program was established to coordinate efforts involving cigarette papers which encompass three established programs - Reduced Sidestream, Project Sigma and Project Tomorrow - as well as working on spotting and papers for high speed manufacturing. One new technology which appears to have significant application to Projects Sigma and Tomorrow is sol-gel technology. Considerable time has been spent in answering the question, Will our present papers be appropriate for the manufacturing equipment of tomorrow? At this time there does not seem to be a problem for the forseeable future.

Little work has be done at R&D dealing with adhesive or ink development during 1989. Although the need for high speed adhesives for higher speed cigarette makers is still an open question, at this time it appears that most operational problems are related to adhesive quality and consistency. One need which has arisen this year is an adhesive which can function at high speeds for papers coated with inorganic gels. Also we need to better understand the mechanism and function of adhesives and better define adhesive composition. As was mentioned above in the section on Suppliers, we have recently signed a secrecy agreement with National Starch which will provide us with information regarding formulation information for their adhesives.

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A need for water-based inks was identified last year. Although no development work in this area has been carried out at PM USA R&D, our suppliers have made considerable progress in reaching this goal.

Other new technologies which have been worked on during the past year are membrane separations for removing nicotine from a supercritical carbon dioxide stream, catalysts for oxidation (or reduction) of carbon monoxide, and chemical sensors, particularly the circular dichroism sensor to determine on-line nicotine concentration during Project ART extraction.

New strategic technologies will be identified this year. However, particular emphasis must be placed in implementation of new technologies already developed at R&D. Another priority for 1990 will be to increase communication between the Technology Assessment function and the R&D scientific staff. One approach, which would also serve to provide a formal forum for R&D professionals, would be a regular seminar series to discuss both technologies under development and new technologies not yet being investigated.

Situational Analysis Summary

A summary of the situational analysis is presented in Tables 9-12. Tables 9 and 10 list internal strengths and areas which need improvement developed from our internal situational analysis, while Tables 11 and 12 list external threats and opportunities developed from our external situational analysis. It should be noted that action plans to address those areas within R&D which need improvement are given in Section F.

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TABLE 9

Internal Strengths Developed from Internal Situational Analysis

1. Broad scientific base augmented by recent new hires.
2. Rapid response to short-term goals.
3. Good short-term operational plans.
4. Well placed university contacts.
5. Good physical resources.
6. Money available for justifiable programs.
7. Considerable multi-divisional interactions.
8. Good understanding of conventional cigarette construction.
9. Local manufacturing/engineering/computer support.
10. Technically strong staff.
11. R&D programs focused.
12. Planning oriented toward business objectives.
13. Improved effort in alerting outside groups early with respect to technology transfer issues.
14. Increased developmental opportunities because of a more flexible organization.
15. Increased interaction with other PM Companies.
16. Improved financial planning.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 10

R&D Areas Needing Improvements Developed from Internal Situational Analysis

1. Technology transfer within R&D and between R&D and other Operations Departments can still be improved further.

2. Lack of knowledge of cigarette manufacturing and processing by bench scientists; however, improvements are being made.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 11

External Threats Developed from External Situational Analysis

1. Pressure to increase taxation.
2. Government regulation of cigarette construction (ignition propensity).
3. Government regulation of additives.
4. Social unacceptability.
5. Foreign competition.
6. Product liability.
7. Development of radical new products.
8. Erosion of margins due to expansion of price tiers.
9. Smoking and health issues.
10. Limitation or ban on advertising.
11. Potential product tampering.
12. Introduction of radical new products by competitors.
13. Government attack on nicotine.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 12

External Opportunitles Developed from External Situational Analysis

1. Product **"perceived"** as being "safer" by the consumer.
2. International market demand.
3. Menthol products.
4. Growing ethnic markets.
5. Proprietary processes and products.
6. Environmental smoke abatement - design and specifications.
7. Reduce cost of manufacturing.
8. Reduced ignition propensity product.
9. Non-conventional cigarette.
10. Nicotine-free cigarette.
11. Article which will give smoker satisfaction in non-smoking situations.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

C. FIVE YEAR GOALS AND FUTURE FACTORS WHICH INFLUENCE THESE GOALS

PM USA Five Year Goals

The latest PM USA Financial Plan outlined objectives for the next five year period. These are as follows:

1. **Volume growth of 14.7 billion units.**

2. **Market share growth of 9.0 market share points to achieve 50.9 percent of the industry.**

3. **Share growth in full margin by 10.9 percent to achieve a share of 55.2 percent.**

4. **Share growth in price/value of 11.2 percent to achieve a share of 35.0 percent.**

5. **Accelerated new product programs to respond to changing consumer tastes.**

6. **Continued investment in the cigarette business, including new assets and technologies where appropriate.**

Except for volume growth, which was reduced 1.7 billion units, all of the objectives listed above meet or exceed those given in last year's Plan. The 25 cent per pack excise tax increase in California in 1988 was cited as the causative factor for the projected volume reduction due to the significant share of industry sales in California (10%) and PM's share of that market (50%).

These goals were formulated in the context of a projected industry decline of 64 billion units over the next five years. According to the PM USA plan, PM's competitors are forecasted to lose 79 billion units in the same time frame. Therefore, PM USA volume growth will be achieved by not only taking market share/volume from competitors but also by introducing innovative new products which will have a positive impact on the declining industry market volume.

Based on these PM USA objectives, a number of strategies were delineated. Those relevant to R&D are listed below:

1. New product strategy featuring innovative product concepts. Existing brand imagery and heritage will be utilized to enhance new technology products, when appropriate.

2. Maximize cost efficiencies throughout PM USA. Reduce overhead cost.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

3. Meet growing production requirements within existing facilities, while maintaining manufacturing flexibility, improving product quality and ensuring a stable supply of quality leaf tobacco.

4. Protect industry volume by appropriately responding to anti-smoking attacks and defending the rights of smokers and manufacturers.

The response of R&D to these PM USA Plan Strategies, as well as specific future trends which will affect our industry/R&D, are covered in detail in the section on Analysis of Future Factors.

Analysis of Future Factors

Twenty-four factors have been identified which may have significant impact on our business in the future. Each factor has been considered individually in terms of its impact. The status of the situation surrounding the factor is provided and a likely scenario is identified. A list of current recommendations regarding PM's response to the factor is given. R&D programs and/or actions which address our position relative to each factor are also discussed. Alternate scenarios and R&D responses are provided where appropriate. In situations where current programs are not sufficient, new programs are proposed and/or actions recommended.

1. **Competitive Pressures**

a. Domestic Competition

(1) Existing Business

Status - PM USA achieved a share growth of 1.5 market share points to reach 39.3 percent of the industry in 1988. The company posted a 1.7% increase in unit volume and was the only domestic cigarette company to increase sales in 1988. This successful performance, in the face of a 2.1% annual decline in total domestic industry sales, was achieved largely through the consistent growth of Marlboro, the national introduction of Marlboro Lights Menthol, and substantial growth in the branded generic category with Cambridge. The company's growth continued in 1989 with a projected increase of 2.6 market share points and a year end projected market share of 41.9%.

Of our competitors, only American Brands with Malibu and American Lights, was able to achieve an increased market share in 1988. R.J. Reynolds, our main competitor, lost eight billion units and 0.7 market share points to settle at 31.8% of the market. RJR showed strength in the price/value category with Doral, but lacked strength

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

in the full margin category. RJR's innovative Premier was taken off the market in early 1989. This product will be discussed in detail in the section on New Products. Both B&W (Kool, Capri, Richland 100's) and Lorillard (Newport) were able to maintain market share in spite of unit volume losses. Liggett, however, suffered significant losses in volume (-22.8%) and market share (-0.8%). At this rate of decline, Liggett will go out of the tobacco business within this plan period.

A graphic analysis of each product category (non-filter, menthol, full-flavored filter, light filter, ultra lights filter, ultra low tar filter, slims/120's filter, generic, branded generics, value 25's, "price-off" (brands which carry a permanent coupon on the carton), and export) is found in Appendix G. Both market share and growth rate data (1986-1988) are provided for each company and category. PM clearly dominates the following segments: full-flavored filter, light filter, ultra lights filter, slims/120's filter, and export segments. In addition, in spite of an overall industry decline in unit volume, PM has achieved growth in the following segments in 1988: menthol (introduction of Marlboro Menthol and Marlboro Lights Menthol); light filter (growth in Marlboro Lights), ultra lights filter (addition of Merit Ultra Lights 85's and 100's); slims/120's filter (Virginia Slims); generics; branded generics (Cambridge and Alpine); and export.

A summary of PM's position relative to total market share and growth is shown in Table 13. This Table shows that PM is positioned well and dominates all market segments which account for more than six percent of the industry's market volume with the exception of the menthol category. Table 14 provides an overview of the products and companies having significant impact on the compounded annual growth rates reported in Table 13. Recommendations on PM USA R&D's response to domestic market competition in segments where PM is considered to be under-represented are discussed in the next section.

Domestic competition is not limited to the other tobacco companies. Smokers quitting smoking independently, through smoking cessation programs, or with the assistance of "chemical deterrents," is among our most significant competitors in the existing business. Products which address the needs of our consumers and the concerns of our potential consumers are clearly needed in order to compete in today's environment. Due

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 13

PM Versus Industry
Market Share and Growth

Rank in Total Market	Segment	Share of Market Volume*	Total Industry 1986-1988 Growth Rate of Segment	Total Industry Minus PM 1986 - 1988 Growth Rate of Segment	PM's Growth in Segment	PM's Share of Segment
1.	Full-Flavored Filter	28.1%	- 4.0%	- 5.9%	- 2.3%	56.0%
2.	Menthol	26.9%	- 3.0%	- 4.0%	+ 1.5%	18.9%
3.	Export	22.3%	+32.8%	+48.1%	+24.0%	57.1%
4.	Light Filter	21.8%	- 0.9%	- 4.1%	+ 1.5%	32.8%
5.	Branded Generics	6.0%	+32.0%	+20.7%	+77.0%	30.8%
6.	Ultra Light Filter	5.0%	+ 0.5%	- 2.5%	+ 6.2%	38.0%
7.	Non-Filter	4.5%	-10.0%	-10.0%	-14.0%	1.6%
8.	Generics	3.3%	-15.0%	-17.6%	+84.0%	7.7%
9.	Slims/120's	2.9%	- 4.4%	-10.6%	+ 0.5%	60.0%
10.	Ultra Low Tar (<0.5 mg tar)	2.8%	- 5.9%	- 4.5%	-72.0%**	0.2%
11.	Price-Off	1.9%	+ 2.9%	+ 2.9%	0	0
12.	Value 25s	0.6%	-27.0%	-27.4%	-26.0%	38.0%

* Products may have been considered in more than one segment.

** Cambridge <0.5 discontinued.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 14

Products/Companies Having Significant Impact on 1986-1988 Compounded Annual Growth Rate for Domestic Product Sectors

		Industry - PM	PM
1.	Full Flavored Filter	(-) Winston	(-) Marlboro
2.	Menthol	(-) Salem (-) Kool (+) Newport	(+) Marlboro Menthol (+) Marlboro Lts. Menthol (+) Alpine (+) Virginia Slims Menthol (+) Cambridge Lts. Menthol
3.	Export	(+81.7%) B&W (+33.7%) AB (+30.0%) RJR	(+24.0%) PM
4.	Light Filter	(-) Winston Lts.	(+) Marlboro Lts.
5.	Branded Generics	(+) Doral	(+) Cambridge (+) Alpine
6.	Ultra Lts. Filter	(+) Winston UL (<->) Vantage UL (-) Tarryton Lts. (-) Carlton	(+) Merit UL
7.	Non-Filter	(-) Pall Mall (-) Camel (-) Lucky Strike (-) Chesterfield	(-) Philip Morris
8.	Generics	(-21.3%) LG (-12.8%) B&W	(+84.0%) PM
9.	Slims/120's	(-) More (-) Carlton (-) Eve	(+) Virginia Slims (-) Saratoga
10.	Ultra Low Tar (<0.5 mg tar)	(+) Now (-) Barclay (-) Kent (-) True (<->) Carlton	(-) Cambridge (<0.5) discontinued
11.	Price-Off	(-) Raleigh (-) Belair (+) Malibu (-) Chesterfield	
12.	Value 25s	(-) Richland (25s) (-) Newport (25s)	(-) Players Lts. 25s

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

to the nature of some of the issues we will need to address, novel products will need to be developed which will satisfy these issues. The situation will be discussed further in the section on New Products.

Likely Scenario

Price/Value Category - In 1988 the price/value category was the fastest growing segment in the industry with the exception of the export segment, and this trend is continuing in 1989. Branded generics were responsible for most of this growth by providing the best alternative to price-conscious smokers wanting to retain quality and taste advantages as well as image. Aggressive industry pricing, to maintain profit growth in the face of declining volumes, will increase demand for products in this category. The growth of Alpine and Cambridge will likely increase PM's share of this segment.

Because of the aggressive pricing strategy of the industry over the past few years, the evolution of a third price tier (Project Basic) is likely. PM USA strategies relevant to R&D in this area include capitalizing on opportunities against competitive products (including a third price tier) with new products. These products must be differentiated from those of out competitors by maintaining uniform standards of quality, while at the same time pursuing strategies to keep costs to a minimum.

The Price/Value category has another important dimension. Instead of marketing a product at a lower price, providing additional benefit to the consumer would also provide a competitive advantage. Currently, the market seems to be focusing on lowering the price; however, products which address the needs of the consumer (value-added) would stand alone and not be affected by the pricing policies of our competitors. Thus, it is important to view this issue from the perspective of increasing value to the customer by improving quality irrespective of the price of our full-margin brands. Automated inspection systems, freshness improvements, maintaining consistency, and improved packaging are all potential ways to increase benefit to the consumer.

Menthol - The introduction of Marlboro Menthol and Marlboro Lights Menthol is responsible for our growth in this category in 1988 despite an industry decline of three percent. The Marlboro name will be a major factor in maintaining the momentum of this product. The continuing decline of Kool and Salem will likely increase PM's share of this segment. In addition R&D is

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continuing to aggressively develop new menthol products to compete with Newport and Kool.

Ultra Low Tar (<0.5 mg tar) - Only RJR (Now) has increased volume in this category which is declining at a faster rate than the overall market. PM's significant decline in the segment in 1988 was due to the pull-out of Cambridge (<0.5 mg tar). Obviously, maintaining sufficient taste at low tar levels is our ultimate challenge. The Low Tar/High Flavor program is addressing this challenge.

Non-Filter - This segment is declining rapidly and accounts for less than 5% of the market. Therefore, a new product introduction in this category would not be successful. As mentioned in last year's R&D plan, a non-filtered price/value entry might do well because the majority of non-filter smokers are older smokers who tend to be price-sensitive.

R&D Programs

Menthol
Low Tar/High Flavor
Filter Research
Domestic Product Support
Optical Processing
Operations Support
Project Basic
Project Target

(2) New Products

Status - As our competitors face a declining total market and declining market share, a likely strategy could include the introduction of products unlike those known to us today in order to create a new market niche. Clearly, certain resources would be necessary for a tobacco company to develop radically new products; however, introduction of a radically new product need not be limited to existing tobacco companies. Therefore, the tobacco companies with resources to compete in this area as well as companies outside the industry with appropriate resources are potential sources of competition in this category.

Both RJR and B&W have the resources to compete in this area. In fact, there are indications that our competitors are maintaining or strengthening their resources in R&D. The KKR buy-out of RJR has not yet produced dramatic reductions in R&D personnel. In fact, half as many cuts have been announced for R&D thus far as had been expected by Wall Street analysts. In addition sources indicate that RJR is continuing the

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development of a Premier-like product. Apparently RJR is focusing on the subjective quality of the product.

While RJR appears to be maintaining their resources to develop new products, B&W has launched an aggressive campaign to increase "our professional team...to support our innovative research and development programs" (taken from an ad in C&E News). While the move may reflect B&W's strategy to address their significant decline in all segments except the export segment; another partial explanation may relate to the severe reduction in staff of BAT's research facility in Southampton. In addition, even Lorillard has recently advertised for an Analytical Biologist. In summary, all indications point toward increasing competition in the innovative product category.

In the past year we have seen RJR's Premier, a radically new product, come and go. We have learned from this product that two main objections need to be addressed for a product in this category to be successful. First, RJR was not able to maintain the subjective quality of the product at an appropriate level. Second, because the product delivered nicotine, a substantial amount of negative publicity and potential government action was generated in response to claims that Premier was functioning as a "drug delivery device." A product which addresses these negative factors would clearly have an advantage.

Likely Scenario - Competition will increase in the face of declining market volumes. Innovative products, designed to address consumer needs, could result in a slower rate of decline or even possibly no decrease in sales. PM must maintain and/or continue to strengthen both internal and external resources essential to the development of innovative products. In addition both competitors and consumers need to be closely monitored to help ascertain the technologies of importance and determine how to utilize these technologies to address the needs of the market place. No product of this type is expected from our competitors in 1990. However, it should be noted that the success of NEXT might well lead to the development of competitive low nicotine products.

R&D Programs

Project Sigma, Beta
Project ART
Reduced Sidestream/Paper Technology
Project Ambrosia

Alternate Scenario - Decreasing competition might occur if the buy-out of tobacco companies results in extensive debt which must be serviced by "milking the business."

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

While this does not appear to be occurring with RJR, the long-term impact of the buy-out on RJR's operating strategy is not readily discernible. In addition, the apparent desire of Sir James Goldsmith to buy out BAT may result in less domestic competition. Clearly, this take-over trend may impact any tobacco company, because the high profit and cash flow make the ability to repay the debt more realistic.

R&D Response - In order to capture market share under these circumstances, resources would shift toward the development of products designed to directly compete with the major products of the bought company. This strategy would enable us to capture market share from the competitor at a time when their support for their products is likely to decline.

Alternate Scenario - Domestic competition may be impacted even further if a foreign competitor buys all or part of a domestic tobacco company. This may give the foreign competitor access to US blending technology and trademarks which would provide a clear advantage in competing with the US export segment.

R&D Response - Strengthen export/international support in order to deal with the increasing competition in international markets.

b. Foreign Competition

Likely Scenario - The situation in this category remains unchanged from last year's plan. Briefly, a foreign competitor may compete by buying a domestic tobacco company or by marketing their products in the US. The latter seems to be limited by the lack of a distribution system, US blending technology and any marketing advantage for their product.

R&D Programs

International Product Support
Operations Support

Alternate Scenario - A market advantage may be attained by a Japanese company marketing a Japanese brand at a lower price.

R&D Response - Maintain an active program for development of brands with high quality and added value.

2. Social and Political Influences

a. Health Concerns of Customers and Potential Customers

Likely Scenario - As mentioned in last year's plan, anti-smoking concerns have been widely publicized, and we are

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likely to have experienced the major impact of this campaign. All current smokers have undoubtedly heard the claims of the anti-smoking groups and have made their decision to continue smoking. In addition, the outcome of the Cippilone trial has essentially staved off any major increase in the legal cases surrounding health concerns. Therefore, the market trends relative to this issue are not expected to worsen dramatically. However, consumer research has indicated that a product "perceived" to have fewer health problems would be very successful if it stayed within appropriate levels of subjective quality and price. There are approximately three times more non-smokers (potential smokers) than smokers in the U.S. If the tobacco industry is to increase unit volume in the future, potential smokers must become our customers. Successful programs which address consumers' desires are likely to have a major positive impact on the industry.

R&D Programs

Project Sigma/Beta
Project ART
Selective Filtration
Lowered Biological Activity Program
Low Tar/High Flavor

Alternate Scenario - As discussed in last year's plan, two possible developments are: (1) clear establishment of a link between a smoke component and a specific pathology and (2) development of an in vivo bioassay which would confirm the link. Due to the potential impact on the industry, R&D programs must continue to address all aspects of this issue.

R&D Response

Continue fundamental research on the biochemical effects of cigarette smoke. Work should be done to confirm outside findings and monitor product changes. This response is currently being addressed through the Lowered Biological Activity Program.

Continue programs designed to develop ways of removing specific compounds attacked by the anti-smoking groups. Programs currently addressing this issue are the Tobacco Specific Nitrosamine Program and Selective Filtration. We will need increased effort on the latter program during the plan period.

Develop novel products such as Sigma, Beta and ART.

b. Ignition Propensity

Status - Federal legislation is currently pending on this issue. In 1984, the Cigarette Safety Act (Moakley/Cranston) created the Technical Study Group (TSG) to investigate the behavioral, economic and commercial feasibility of developing

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a cigarette with a minimum propensity to ignite upholstered furniture. The TSG determined such a cigarette was technically feasible and may be commercially feasible. Senators Moakley, Cranston, and Heinz have sponsored a bill which would require the NBS to develop a performance test method in one year, after which a fire safety standard would be established and compliance would be required within one year. An industry sponsored bill (Boucher/Bliley) has been introduced which requires investigation into the development of a test. Currently, a Coresta Study Group is working to develop a reproducible test which will distinguish among cigarettes.

Likely Scenario - Federal legislation will result during the plan period that is likely to be a compromise between the Moakley/Cranston/Heinz bill and the Boucher/Bliley bill. The Federal legislation will most probably specify the performance rather than design of the cigarette, allowing for more flexibility in the possible solutions to the situation. We must face the potential challenge of a major change to our entire product line. Several approaches are being investigated some of which require advanced technology.

R&D Programs

Project Tomorrow
Paper Technology Program

Alternate Scenario - As indicated in last year's plan, there are three other possible scenarios to this situation. They are: (1) introduction of a successful fire safe cigarette by a competitor; (2) the Federal law specifies design rather than performance; (3) multiple state and local laws are passed with a variety of requirements.

R&D Response - Develop a satisfactory fire safe cigarette in anticipation of the Federal law. Work to ensure that any law passed is based on a performance standard.

c. Social Concerns

Status - The current emphasis by anti-smoking groups seems to be moving from the smoker to the non-smoker (ETS, cost of smoking) in an attempt to use pressure from the non-smoking population to exert informal restrictions on the smoking population. These informal restrictions are leading to wider acceptance of formal legislation restricting smoking. Numerous pieces of legislation have been considered on the Federal, state and local level, and the momentum has been gathering and will likely continue. On the Federal level a smoking ban on all domestic flights appears to be imminent. Other legislation has ranged from requirements for warning labels on buildings where smoking is permitted to hiring policies which discriminate against smokers. Many of the other restrictions are summarized in Appendix F.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

In addition increased pressure from various groups has resulted in smoking restrictions in both public and private facilities. These groups have attacked environmental tobacco smoke (ETS) in general and specific compounds which are part of ETS. This pressure continues, and it appears that future pressure will be directed toward control of specific compounds.

One approach to the problem of smoking restrictions initiated in 1989 is Project Pact. Project PACT is pursuing the objective of developing technology to treat indoor air so that it will not be irritable to smokers and non-smokers. The program is designed to accomplish the following:

Phase I - Reduce particulate concentrations
Phase II - Reduce gas phase concentrations

Initially, efforts are being directed toward developing treatment technologies for smoking lounges in arts centers and theaters where high levels of smoking are expected for short durations.

Likely Scenario - Smoking restrictions of all kinds are likely to increase. No alternate scenario is anticipated.

R&D Programs

Reduced Sidestream/Paper Technology
Projects Sigma, Beta
Project Ambrosia
Project PACT

d. Advertising or Partial Advertising Ban

Status - In 1988, cigarette advertising and/or promotion restrictions were considered in 19 states and the Federal government. Only a minor restriction on advertising in public transportation was passed in Washington, D.C. Federal legislation is now pending which may prohibit tobacco advertising using human figures, brand names or logos, pictures (except of product at no larger than actual size), free samples or discount coupons, and advertising within 500 feet of schools or where sports activities occur. The legislation also requires that the tobacco product package be white with black letters. A new Canadian law is pending legislative action. This law could pose severe restrictions on tobacco advertising and promotion, and could impact legislation in the U.S.

Likely Scenario - A partial advertising ban will be passed within the plan period.

R&D Response

Develop novel products which are newsworthy.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

Develop products that would be easily recognized as different by the consumer.

e. Surgeon General's Report

Status - The 1988 Surgeon General's report which claimed that nicotine is as addictive as heroin and cocaine is not factual and is not taken seriously by most reasonable people. However, the report has provided credence to the claims of anti-smoking groups and provides a possible basis for government control of the cigarette industry. The 1989 Surgeon General's Report, marking the 25th Anniversary of 1964 Surgeon General's Report on Smoking and Health, was due to issue in January of 1989. To date this report has not formally issued. Interestingly, the reason for delay appears to relate to a lack of consensus on what the report should say.

Likely Scenario - Documents of this type will provide the ground work for additional restrictions on the industry in the future.

R&D Programs - PM is well positioned to address any degree of concern the 1988 Surgeon General's report may have generated. NEXT is in test market and will specifically address the nicotine issue. A thorough evaluation of future Surgeon General's reports should conclude with recommendations for R&D actions. Careful evaluation of the strategy of the next Surgeon General should be made.

f. Regulation of Ingredients

Status - Submission of qualitative ingredients lists to HHS Office of Smoking and Health has been required of the Tobacco Industry since December 31, 1985.

A review of all tobacco industry ingredients may be carried out by the Office of Smoking and Health. A report, which could be in the form of a monograph and be subject to internal and external peer review, could result from this review. Whether or not ingredients will become a major issue during the plan period yet remains to be seen.

Legislation relating to ingredients is currently pending in Congress. The "Tobacco and Nicotine Health and Safety Act of 1989" would, among other things, require full disclosure of all chemical additives in tobacco products and give the Secretary of HHS the authority to reduce the levels of additives perceived to be harmful or prohibit their use. In 1989 the government of Canada passed a regulation which did indeed require all cigarette additives to be disclosed. Our response to this law was to withdraw our brands from the Canadian market. Clearly, this could not be done if a similar law were passed in the US.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

Likely Scenario - The HHS report may issue in 1990 and may result in the following: requests for additional information on certain ingredients; requests for elimination of certain ingredients; and labeling requirements.

R&D Programs - An extensive review of ingredients has been underway at PM for the past four years. From 1986 to 1988 the number of ingredients utilized for all PM USA products has been decreased by 22%. Project Natural, involving the development of a product with a minimum number of additives, is a key part of R&D's effort to address this area. If labeling becomes necessary, a distinct advantage will be realized logistically with the fewest number of ingredients. Requests for additional information and/or elimination of ingredients may result in a significant impact on the resources of the Analytical and Biochemical Research Division as well as Flavor Development. In addition work is ongoing to replace synthetic ingredients with natural ingredients where appropriate. Work to replace natural ingredients with synthetic ingredients may be warranted if the non-specific nature of most natural ingredients presents a problem. Due to the need to maintain ingredient information proprietary for each brand, it is essential that this issue be handled at the industry level. Therefore, any problem that may surface relative to ingredients would be a problem for all tobacco companies.

g. Government Regulation of Tar and Nicotine

Likely Scenario - As mentioned in last year's plan, a significant number of foreign governments will regulate tar and nicotine levels in the future.

These future restrictions will have a significant impact on both International Product Development and Semiworks personnel. ART filler may be utilized to deal with the situation. However, additional resources and capacity would be required to handle the work load.

R&D Programs

Project ART
Operations Support
International Product Support

h. Strategy of Anti-Smoking Groups

Status - A review of the status of anti-smoking groups activities, as well as a Nonsmoking Ordinance Guide, is provided in Appendix F. The strategy of anti-smoking groups appears to be to use every means possible to eliminate tobacco smoking in the U.S.

Likely Scenario - Perhaps the only strategy that would be ultimately successful in dealing with anti-smoking forces

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

would be to mount aggressive programs to methodically eliminate their concerns. Certainly, Project ART is an excellent example of such a strategy. The introduction of NEXT, on the heels of the 1988 Surgeon General's Report on Nicotine Addiction, couldn't have been timed better. Initial reaction to the product indicates NEXT will not attract the intense opposition that Premier received. Premier was designed to address concerns relating to smoking with two notable exceptions, nicotine and carbon monoxide. As a result, anti-smoking group reaction to Premier was intense and claimed the product acted as a "drug delivery device." In fact legislation has now been proposed on the Federal level to categorize non-tobacco products containing nicotine as drugs. The Tobacco and Nicotine Health Safety Act of 1989 (R. Whittaker, R - Kansas) also stipulates such products are to be regulated by the FDA.

R&D Programs - All programs which address concerns voiced against smoking will benefit our position on eliminating these concerns. A family of new products which utilize ART tobacco may offer a clear advantage in our current environment. Programs which fall into this category include:

Project ART
Project Sigma/Beta
Project Natural
Project Tomorrow
Lowered Biological Activity
TSNA
Filtration Research
Reduced Sidestream/Paper Technology
Project PACT
Selective Filtration
Membrane Separations

i. Product Tampering

Likely Scenario - An incident of product tampering with cigarettes is feasible and could have catastrophic effects. There is a Crisis Management Team that meets regularly which would undoubtedly formulate responses to such an incident. However, it is important for R&D to adopt a proactive stance on this issue.

R&D Programs - Since packaging is an issue facing all consumer products companies, this particular issue affords much opportunity for synergy among PM companies.

j. Environmental Issues

Status - Environmental issues of all kinds are having an increasing impact on the way we do business. State and local governments have proposed legislation to begin to address concern over solid waste disposal problems. Legislation ranges from bans on specific packaging materials to bans on

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all non-recyclable or non-degradable packaging materials. Other proposals include taxes on manufacturers of "litter-producing" articles. The tobacco industry may need to address a packaging tax and restrictive legislation in a dozen or more states in 1990. In addition, on the local level, air, water, sewer, and landfill restrictions are likely to become serious issues during the plan period. The impact of addressing the problems associated with these issues ranges from increasing the cost of doing business to the need for a radical change in the way we do business relative to the environment. While most of these issues are of potential concern to all who generate waste, some of these issues would be very difficult to deal with effectively. In addition, in many instances, solutions to environmental issues are directly counter to more efficient and faster operations. Additional information on environmental issues facing PM provided by E&EP personnel is found in Appendix H.

Likely Scenario - Environmental issues will begin to heavily impact the industry within the plan period.

R&D must begin to address these environmental issues head-on. Because solutions to these problems will undoubtedly require the development of new technologies and innovative processes and products, the development of a proprietary position in waste management technology would clearly benefit the company's ability to do business. Clearly there are obvious opportunities for corporate wide synergy in this area. However, in many cases, environmental issues are narrowly focused to the specific components utilized in the product or process and how they are handled. Within the next two years this area should be thoroughly evaluated and a plan written to outline R&D's response to dealing with these issues. This would best be accomplished by an Environmental Engineer who would function as a liaison between R&D, E&EP, PM USA facilities, and Engineering, and coordinate R&D programs to address specific needs that are identified.

R&D Programs

Operations Support
Synergy Committee
Nicotine Destruction
Project Grain
Reconstituted Tobacco Development

k. Other Government Regulations

Other government regulations could indirectly impact the way in which we do business. Examples include: forbidding consumer panel testing, government regulations affecting direct materials (e.g., dioxin in paper), and restricting exports.

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R&D Response - Possible response to these and other possible regulations will be formulated, as necessary.

3. **Market Dynamics**

a. Declining Domestic Market

Status - The latest PM USA financial Plan forecasts a declining industry volume of approximately 3.0 percent annually. In spite of this, the plan forecasts a domestic volume increase for PM USA of 14.7 billion units to 235 billion by 1993. Full margin (Marlboro), price/value (Cambridge, Alpine), and new products are expected to yield the forecasted results. A market share of 50.9 percent (increase of 9.0 share points) is projected for 1993.

Likely Scenario - An analysis of the compounded annual growth rate for various market segments is shown in Appendix G. While PM's performance in full-margin products is generally excellent relative to competitors and the general market trend, the current trends in this category do not reflect the needed 7.1% increase (1.7% compounded annual growth rate) in volume over the next five years. As indicated in the five year plan, the price/value category clearly offers opportunity to realize a portion of these goals with a current compounded annual growth rate of +8.4% for the industry and +47% for PM. However, the price/value category currently represents only 11% of the industry volume and 5.9% of PM's total domestic volume. In addition, profit margins will need to be protected by continuing to develop cost efficient manufacturing methods. Based on this analysis, it appears essential that new products be introduced to capture market volume; address concerns of customers and potential customers (pro-active); and deal with the mounting restrictions placed on our product (reactive).

R&D Programs - Develop products which provide a benefit to the customer. R&D programs which address this strategy include:

Project ART
Low Tar/High Flavor
Project Sigma/Beta
Project Ambrosia
Reduced Sidestream
Domestic Product Support

Support development of price/value segment by increasing the resources addressing this segment in Product and Process Development in order to lower costs.

Alternate Scenario - If the rate of decline in industry volume is more than anticipated or a new legislation dramatically impacts our ability to do business, R&D programs

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will need to be refocused to maximize our utilization of all opportunities the situation will afford us.

b. International Market

Likely Scenario - Table 15 offers an analysis of current worldwide, international and domestic market trends for both PM and the industry. Both the volume and rate of growth of the international market offer some clear opportunities. In addition, the quality and availability of domestic leaf can sometimes provide a clear product advantage to a U.S. company in the international market.

R&D Programs

Work with PM Europe R&D to provide efficient resolutions to problems common to both markets.

As needed, make available to PM Europe R&D, skills/technology/resources they do not have.

International Product Support
Cast Sheet RCB Process
Filter Research

c. Obsolescence of Our Current Product or Processes

Likely Scenario - Products - In order to address consumers' and potential consumers' concerns while dealing with a declining market radically new products will be essential. Clearly there has been an extensive amount of activity in this area (Next, Superslims, Vantage Excel, Premier and Chelsea), and we know these programs are continuing and/or being extended. Focus group testing has indicated that consumers are enthusiastic over the concept of a product such as Premier. If products such as nicotine chewing gum and nicotine patches are used as cigarette substitutes by a significant number of our customers, the loss in sales could not be regained by marketing a conventional product. While obsolescence of our current product is not likely within the plan period, technological breakthroughs and innovative products are highly likely in the next ten years. Consequently, our efforts to develop innovative new products should receive high priority.

R&D Programs

Projects Sigma, Beta
Project ART
Reduced Sidestream/Paper Technology
Combustion Research
Aerosol Research

Likely Scenario - Processes - Environmental issues, new products requiring new processes, and the increased need for

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 15

Worldwide, International and Domestic Market Trends*
(in billions)

Industry	1986	1987	1988	Compounded Annual Growth Rate 1986 - 1988
Total Worldwide	4,975.0	5,118.0	5,200.0	+2.2%
Total International	4,391.5	4,547.0	4,642.2	+2.8%
Total Domestic	583.5	571.0	557.8	-2.2%
Philip Morris				
PM Worldwide	506.8	540.8	556.4	+4.8%
Market Share	10.2%	10.6%	10.7%	
PM International	292.3	325.2	337.1	+5.7%
Market Share	6.7%	7.2%	7.3%	
PM Domestic	214.6	215.6	219.3	+1.1%
Market Share	36.8%	37.8%	39.3%	

*Figures include cigarettes designated for the military.

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proprietary and efficient processes will lead to an increased effort in Process Development. A specific example of such a scenario involves the DIET process. PM USA's patents for this process will expire in about two to three years. RJR, B&W and JTI are all working on new processes for expanding tobacco. In addition, both B&W and JTI have a large number of patents in the past year which protect improved manufacturing equipment and methods. These companies may be focusing their efforts on improved efficiency in order to be more competitive in the price/value category as well as lowering costs for full margin brands.

R&D Programs

Second Generation DIET Process
Cast Sheet RCB Process

d. Demographics

Status - Interesting demographic-related strategies may be derived from the recent data in the Consumer Tracking Study - Year Ending June, 1989. PM's share of male smokers exceeded 40% for the first time and PM's share of female smokers exceeded 40% for the second time. PM's gain this past year can be attributed equally to men (0.7%) and women (0.7%) smokers. RJR, however, can attribute all of their losses to women (1.1%). With Capri B&W experienced a slight increase among women smokers.

In terms of age-related demographics, PM far exceeds competitors as the leading cigarette company among the younger age groups (18-34 years), while RJR still maintains a lead among older smokers. Like RJR, B&W, American and Liggett brands all appeal more to older smokers; whereas Lorillard has a significant portion of its business in the younger age groups. Specifically, in the 18-24 year age group Marlboro continues to increase share as have Camel and Newport. However, Kool and Salem are on a continuing decline in this age group, while Merit, B&H, Virginia Slims, and Winston are beginning to experience declines. Marlboro increased share in almost all age groups, whereas Winston declined in all age groups except 55+ years.

Likely Scenario - The scenario remains unchanged relative to last year's plan. Smokers are getting older, decreasing in number and becoming more price conscious. As a brand becomes identified with a certain generation, new smokers may make an alternate choice in order to maintain or establish their own identity. Currently, PM is positioned well in that Marlboro appeals generally to young adults, whereas RJR's products are associated with a distinctly "older" generation. The introduction of Virginia Slims Superslims should strengthen our position against Capri.

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R&D Programs

Domestic Product Support
PED Programs
Project Trim
Project Cosmic

4. **Reliance of R&D on Suppliers**

Status - A significant amount of progress has been made in this area. However, situations could develop which would result in: (1) shortages of raw materials; (2) key suppliers going out of business; (3) unfavorable business relations with suppliers.

Likely Scenario - As new products and processes become an essential part of our business, new technologies and materials will be required which will increase our need to maximize our utilization of suppliers and their resources.

R&D Response

Develop proprietary products and technology to facilitate and control our position and ensure exclusivity for these products from our suppliers.

Complete the establishment of specifications for incoming materials (flavors, papers, adhesives, packaging materials and packaging inks).

Maximize utilization of suppliers and resources. This may result in deliberately reducing the number of suppliers we use for a specific type of material (e.g., adhesives).

5. **Internal Environment**

a. R&D Resources

Likely Scenario - As indicated in the analysis of future factors, all likely scenarios call for an increase in R&D effort. Therefore, if a constant head count is maintained, R&D's ability to implement the plan and address these future factors will be hampered. In addition the mix of skills of the work force will be required to change in order to develop the technologies for future products. Opportunities, including continuing education, broadening reassignments, and additional training, will need to be made available to new and existing employees in order to obtain and maintain the work force necessary to carry out the plan in future years. Specific issues include the availability of individuals trained in certain technologies, as well as the availability of US citizens to handle sensitive defense-related technologies. In addition it is highly unlikely that existing facilities and equipment will be able to adequately support novel product development or eventual manufacturing.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

R&D Response

Address needs for additional resources by first examining priorities and shifting personnel when feasible. Increase head count in appropriate areas after careful consideration of all possible alternatives.

Determine the relative advantages of carrying out a specific piece of research or development work utilizing outside or in-house resources. Outside resources can be used advantageously when a) the project will be of short duration, b) it would require too great investment in either physical or people resources to conduct the project in-house, or c) a feasibility study is necessary before a decision can be made as to whether or not we intend to seriously commit resources to a program.

Develop action plans to address the projections of a changing work force and the potential shortage of technical personnel with training and reward programs designed to attract and motivate employees and improve overall efficiencies. For example, a post-doctoral program at R&D would allow individuals who were recently trained in a specific technical area to transfer and apply that technology to R&D issues on a short-term basis. This would have several advantages. First, R&D would not have to make a long-term commitment to an individual in order to obtain key technical input. Second, the program would support and encourage individuals with skills in needed areas, as well as provide a trial period for the evaluation of potential permanent employees.

Design and construct necessary equipment and facilities as needed.

b. Manufacturing Support

Likely Scenario - The new manufacturing equipment which can achieve speeds up to 10,000 cigts./minute will require R&D support in order to deal with deficiencies in materials. Certain components, particularly papers and adhesives, may not perform optimally at these high speeds. New technologies (e.g., supercritical extraction) and products will also increase the need for R&D support of manufacturing. The achievement of PM USA's plan volume objectives will be dependent on a significant increase in brands and new products using new technologies and manufacturing techniques.

R&D Response - Continue programs which address manufacturing support. These include work on paper technology, adhesives and optical processing. Develop joint programs with Manufacturing and Engineering to address needs of the future.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

c. Product Quality

Likely Scenario - As the market volume continues to grow in the price/value segment, product quality can become an essential differentiating factor. With three price tiers now a reality, quality must be judged against competitive products in the same price range, and our strategy must be to be superior within each tier . Cost cutting measures should be achieved through the use of new technologies and/or processes which do not significantly impact product quality.

R&D Programs

Operations Support
Optical Processing

d. Cost Efficiency

Status - As indicated in the PM USA Five-Year Plan, cost efficiencies should be maximized throughout the company. New products, new technologies and the large number of issues facing the company in the forseeable future all may threaten to increase the cost of doing business. R&D programs are generally conducted in a manner that maintain PM's proprietary position. While this strategy may increase initial R&D investment, and therefore R&D cost, "ownership" of important product and process technology can certainly lower the overall cost to the company by allowing us to exercise some control over the vendor as well as allowing us to "spin off" or license such technology if it is in our interest to do so.

R&D Response

Continue to consider cost efficiency a major factor in all R&D endeavors.

Continue to focus on programs which will improve our proprietary positions and thereby provide a more cost-effective means of doing business.

Focus resources on issues which may adversely affect the cost efficiency of the company. For example, developing proprietary methods of dealing with environmental issues will improve our ability to do business in a cost-effective manner when faced with environmental restrictions and regulations.

e. Technical Synergy

Status - The diversification of Philip Morris Companies has created the possibility of improving the effectiveness of the individual operating units through a number of synergies. One of these is technical synergy. In order to take advantage of potential areas of R&D overlap, a technical

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synergy effort was initiated in July, 1988, by the research vice presidents of the operating companies. The goal of the groups was to leverage the corporation through joint/ coordinated research activities in order to minimize duplication. The results of the effort have been many. The most important has been the establishment of an informal network of contacts between technical personnel within the operating companies. Catalogs have been established of existing technologies, emerging technologies being tracked, external resources utilized, and facility capabilities. A comprehensive evaluation of our competitors' research personnel, facilities, and activities has ben developed and maintained. More applied results of this effort include numerous examples of successful technology transfer between operating units, several instances of joint technical problem solving, the Technical Symposium program, and exchanges of personnel.

6. External Factors

Technological Advances

Likely Scenario - New technologies are essential to the development of new products and processes which address the areas discussed in this section on future factors. These technologies are important not only to the creation of the product or process, but also to the proprietary position of the company in the industry. Because of the importance in recognizing and evaluating new technologies and their applicability to our product, technology assessment must be accomplished by PM R&D personnel working with outside resources. Therefore, the development and maintenance of outside contacts and resources is essential to maximizing our utilization of technological advances. Within the plan period, important technological advances which would generate a distinct product advantage are likely.

R&D Programs - The Technology Assessment Group functions to recognize (with assistance from all R&D professionals) and evaluate technologies which could be utilized to benefit our position in the industry.

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D. R&D STRATEGIC GOALS

The six strategic goals based on PM USA five year objectives and an analysis of future trends are as follows:

1. **AGGRESSIVELY SUPPORT THE CURRENT BUSINESS.**

2. **DEVELOP PRODUCTS WHICH ADDRESS THE CONSUMERS' DESIRE TO REDUCE THEIR HEALTH CONCERNS.**

3. **DEVELOP PRODUCTS WHICH ADDRESS THE PUBLIC'S DESIRE TO REDUCE ENVIRONMENTAL TOBACCO SMOKE.**

4. **DEVELOP PRODUCTS WHICH WILL INCREASE OUR VOLUME AT THE EXPENSE OF OUR COMPETITORS TO GIVE US OUR "FAIR SHARE."**

5. **IDENTIFY NEW PRODUCT/PROCESS CONCEPTS AND DEVELOP PRODUCTS/ PROCESSES FOR THE INTERNATIONAL MARKET.**

6. **PROVIDE A BROAD FOUNDATION OF BASIC RESEARCH THAT WILL GENERATE NEW PRODUCT CONCEPTS IN 5-15 YEARS.**

Tables 16-21 show for each strategic goal the current and projected programs. For each program both current, given in parenthesis next to the program, and future estimates of resource allocations are given year by year. The rationale for the projected resources allocated to each program are discussed. A breakdown of the resources allocated to each program by Division is given in Appendix I, while Divisional resource allocations and projections are given in Appendix J.

Strategic Goal Number 1 - Support the Current Business

All of the programs that fall into this Strategic Goal, except for the Cast Sheet RCB Process which was formerly part of Operations Support, are already in place as can be seen from Table 16. However, during the next five years emphasis is expected to change. The Operations Support Program covers a number of individual projects including Flavor Specifications, Adhesive Specifications, Packaging and Ink Specifications, Quality Issues, such as Customer Complaints and Burley Spray, Materials Evaluation, Marlboro Standardization, Cigarette Beetle Control, Microbiology, and Alternate Preservatives. During the plan period the Flavor Specifications project will be completed, although work at a maintenance level will continue. Many of the other projects will remain at current levels. A number, however, will need to increase in order to meet future objectives. Increased resources will have to be devoted to adhesive specifications, particularly as the use of papers with unusual properties becomes a reality. Two projects which are not currently being worked on are anticipated as being needed within the plan period. The first involves the development of materials needed as the company utilizes higher speed manufacturing equipment. It is highly likely that both papers and adhesives will have to be developed which can perform without problems at higher maker speed. This program will depend heavily on the development of process simulation. The second new project within Operations Support which will develop during the plan period is process control monitoring. Examples include monitoring blend composition on the fly and primary process control.

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TABLE 16

STRATEGIC GOAL NUMBER 1

Aggressively Support The Current Business

	Resource Allocations* Year				
Program	**1990**	**1991**	**1992**	**1993**	**1994**
Operations Support (80.0)	75.9	79.6	76.7	82.6	82.4
Project Tomorrow (8.0)	10.5	15.1	17.3	14.1	9.0
Reduced Density Rod (21.4)	0	0	0	0	0
Optical Processing (8.4)	11.2	11.2	8.8	8.8	9.4
Tamper Evident Packaging (0.2)	0.6	1.5	1.8	1.2	0.6
Project Natural (2.0)	4.0	2.0	1.5	1.5	1.4
Second Generation DIET Process (7.6)	17.6	17.4	18.0	19.7	19.8
ART Support (51.4)	42.5	33.1	28.2	17.8	17.6
Environmental Issues (3.8)	6.2	7.0	9.3	11.3	12.0
Cast Sheet RCB Process (0)	9.6	11.1	11.6	10.4	10.3
TOTALS (182.7)	178.1	178.0	173.2	167.4	162.5

*Current resources are given in parenthesis after each program.

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Project Tomorrow will require significantly increased resources during the plan period. As was pointed out in the previous section, it is highly likely that a law specifying cigarette performance with respect to fire safety will be passed during 1990. Once this law has been passed, the industry will most likely have two years in which to meet the specifications. Consequently, we have projected that Project Tomorrow will double in size during 1991 and 1992, with decreasing resources being required in the following two years.

The Reduced Density Rod Program is projected to end in 1990, since at this time we have found no salient product advantage for such a product.

Optical Processing is projected to increase slightly during the next two years, since during this period R&D will have the responsibility of implementing the technology that is being and will be developed. Little effort has been devoted to Tamper Evident Packaging during 1989. The possibility of working in concert with Kraft-General Foods to develop technology in this area was explored this year. At this time it does not seem that a joint program will achieve our objectives. Consequently, a slight increase in support of this Program is projected. Two individuals from the process development area will be committed to Project Natural in 1990 to solve a number of processing challenges. After 1990 the Program will revert to the same level of support devoted to it in 1989.

Considerably more resources will be devoted to our work on DIET processes. The objective will be to develop a second generation DIET process which will be designed to improve product quality and increase throughput. A proposal is currently being developed for the design of a continuous gaseous impregnation process. We anticipate a major effort being devoted to this program during the entire plan period. Important advantages of such a process would be less loss of important tobacco flavors, less breakage, the fact that overdrying would no longer be necessary, and the fact that less reordering would be needed. An added benefit of such a process would be a significant reduction in carbon dioxide emissions (see below).

Support for Project ART has utilized a significant portion of the R&D resources in 1989. It is anticipated that this effort will gradually decline during the plan period, with about a two-thirds decrease by 1994.

Our analysis of future trends indicates that environmental issues will have an increasing effect on the way we do business. At present R&D is working on Project Grain in order to minimize the amount of ethanol released from the air from our processes. Potential future challenges include disposal of nicotine from a modified ART process (water column), disposal problems regarding phosphate and nitrate from our reconstituted tobacco processes (see below), and carbon dioxide emissions. In addition it is likely that we may need to initiate work on the development of biodegradable packaging and non-tobacco cigarette components. As a consequence we have

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projected a continuous increase in the resources committed to environmental projects over the plan period.

The need for a more flexible process for producing RCB will require us to increase our resources in this area. Consequently, we have removed this program from Operations Support. It is highly likely that we will exceed our BL sheet capacity within the plan period. We plan to develop a cast sheet process which can produce material that can be used to substitute for either RL or BL. This will enable us to fully utilize our tobacco by-products across all PM product lines. In addition this process will be designed to decrease the amount of phosphates and nitrates discharged into the water stream.

Strategic Goal Number 2 - Reduce Perceived Consumer Health Concerns

As can be seen from Table 17, considerable resources are being devoted to Strategic Goal 2. The two programs with the largest resources are Project Sigma/Beta and Project ART. The withdrawal of Premier from the market caused a shift in strategy for Project Sigma/Beta with the emphasis now being on longer-term research as opposed to product development. Valuable lessons were learned from the reception Premier received from both the customer and the anti-smoking forces. It seems unlikely that a radically new product which delivers nicotine will be allowed to succeed by the anti-smoking groups, and it is perhaps equally unlikely that a very different product which does not deliver nicotine will be accepted in the market within the next five years. There is a high probability, however, that a product like Sigma or Beta will be the product of the future from five to ten years from now. Consequently, we must seize the present opportunity to carry out the research necessary to perfect these products. We anticipate a slight increase in resources devoted to this Program during the plan period as additional product development personnel will be needed to translate the research results into a viable product.

Resources for this portion of Project ART are required to continue to optimize the product, particularly with regard to flavor; optimize the present process; and develop new processes, such as a water column, that will not require the utilization of stems as the adsorbing material. Resources devoted to this aspect of Project ART will decrease by about one-third during the plan period.

Both the TSNA and LBA Programs are primarily defensive in nature. The possibility of the industry being forced to remove certain materials from mainstream smoke in the future is great enough to require that these two Programs be strongly supported. A significant decrease in the resources devoted to TSNA is projected to occur starting in 1993, since it is expected that a number of potential solutions to this challenge will be developed by then. LBA, on the other hand, will require increased resources during the plan period. Basic research in the smoking and health area will become increasingly sophisticated during the next five years, and R&D must be in a position to evaluate conclusions arising from this research which may

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TABLE 17

STRATEGIC GOAL NUMBER 2

Develop Products which Address the Consumers' Desire to Reduce their Health Concerns

	Resource Allocations* Year				
Program	**1990**	**1991**	**1992**	**1993**	**1994**
Project Sigma/Beta (41.8)	44.0	45.9	48.9	48.2	47.2
Project ART (43.2)	40.4	33.1	31.6	30.4	29.6
TSNA (19.7)	19.6	20.6	20.0	15.0	12.0
LBA (18.8)	19.4	19.0	21.6	23.4	25.0
Selective Filtration (1.2)	2.7	3.3	3.9	3.8	4.4
Supercritical Technology (6.5)	10.4	14.6	14.8	19.8	20.4
TOTALS (131.2)	136.5	136.5	140.8	140.5	138.6

*Current resources are given in parenthesis after each program.

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represent external threats.

Selective filtration is another defensive program. The industry has frequently come under fire for certain gas phase components, particularly CO and NO_x. Although it is unlikely that we will be forced to lower the amount of these compounds presently being delivered in mainstream smoke, tangible benefits would result if we could do so. Consequently, an increased effort in this area is projected for the plan period.

The last program which can contribute to the objectives of Strategic Goal 2 is supercritical technology. We have achieved a significant success in the use of supercritical CO_2 for the extraction of nicotine. However, there are a number of other potential uses for this technique. Two examples are the removal of secondary alkaloids from tobacco, and the transfer of flavorants from one type of tobacco to another. The great potential for this technique coupled with our considerable expertise suggest that a significant increase in resources should be devoted to this technology during the plan period.

Strategic Goal Number 3 - Reduce Environmental Tobacco Smoke

Table 18 emphasizes the fact that most of our effort in the area of environmental tobacco smoke is being devoted to the Reduced Sidestream Program. We have had considerable success with the design of products with reduced sidestream visibility in 1989, and anticipate considerable product development efforts in this area in 1990. We do not project a large decrease in allocated resources during the plan period, however, since visible sidestream smoke is only a portion of the problem. It is planned to initiate work on the reduction of sidestream gas phase in 1991 and beyond. It should be noted that the Reduced Sidestream Program will not address the reduction of exhaled smoke. This challenge will require considerable basic research, and it will be addressed in the discussion of Strategic Goal 6.

A new Program covered by Strategic Goal 3 is Project Ambrosia. The design of a product to alter the aroma of sidestream smoke was initiated in 1989 and is expected to require about the same level of resources in 1990. We anticipate that the a product will be developed in 1990, and that work on this Program will require gradually decreasing resources during the plan period.

The ETS program consists of a monitoring function and a proactive program, Project Pact. Additional resources for the monitoring portion are projected for the next two years, after which the level of support is anticipated to decrease. Project Pact is an approach to the ETS challenge which has as its objective the development of state-of-the-art room ventilation systems. Although it is preferable to address the environmental tobacco smoke situation through the design of products, a parallel effort of this type is necessary. Since this approach is of secondary importance, however, the plan shows only minimal resources being devoted to it.

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TABLE 18

STRATEGIC GOAL NUMBER 3

Develop New Products which Address the Public's Desire to Reduce Environmental Tobacco Smoke

	Resource Allocations* Year				
Program	**1990**	**1991**	**1992**	**1993**	**1994**
Reduced Sidestream (46.0)	44.1	38.8	37.6	36.1	34.7
Project Ambrosia/ Ash Tray Odor (9.4)	8.4	6.8	2.7	2.2	1.8
ETS Monitoring (4.7)	7.5	7.5	6.4	2.7	2.7
Project PACT (7.4)	4.7	4.8	3.6	3.6	3.6
TOTALS (67.5)	64.7	57.9	50.3	44.6	42.8

*Current resources are given in parenthesis after each program.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

Strategic Goal Number 4 - Products Which Will Increase Volume at the Expense of Competitors

Programs directed toward this Strategic Objective are listed in Table 19. The first two programs, Menthol and Low Tar/High Flavor, address market areas in which we do not yet dominate. We have been actively working in these areas for some time, and we anticipate that we will continue to do so during the entire plan period. In addition, the fact that our number one competitor, RJR Tobacco, has recently decreased its marketing effort for most of its full margin brands, including Salem, Vantage and Now, provides us an excellent opportunity. We plan to take advantage of this opportunity during the next five years by slightly increasing our resources devoted to these two programs.

The Filter Research Program is a necessary adjunct to both the Menthol and Low Tar/High Flavor Programs. Work is currently ongoing to investigate the possible role of new filter designs for the Reduced Sidestream Program. The importance of novel filters to many of our new product designs necessitates maintaining this Program at its present level during the plan period.

Domestic Product Support encompasses product development work on those new products which are planned to be or are in the early stages of test market or national introduction. The ambitious goals outlined in the PM USA Financial Plan will require an increasing number of new products during the plan period as well as certain novel products, such as reduced sidestream cigarettes, which will require a significant increase in the effort required for this Program. In addition we anticipate that the redesign of at least certain products will be necessary to reduce cost. As a consequence we have planned to increase the effort devoted to Domestic Product Development by about 40% over the next five years.

Strategic Goal Number 5 - International Products

The fact that sustained growth is anticipated in the international market will require greater involvement from PM USA R&D. As can be seen in Table 20, resources allocated to International Product Support are expected to increase significantly during the plan period. This increase is necessary not only for products exported directly by PM USA, but also to support other international efforts.

The other three programs covered under Strategic Goal 5 are much narrower in scope. Work on the TMCI BL Process is included in the new Cast Sheet RCB Process, discussed under Strategic Goal Number 1, from 1990 on. As was pointed out in the discussion of future trends, a large number of international brands will have to repositioned during the plan period in order to comply with government regulations regarding tar and nicotine levels. PM USA R&D will be required to allocate some resources to support PM International in order to meet this objective. Lastly, a portion of the Filter Research Program is devoted specifically to PM USA export brands,

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TABLE 19

STRATEGIC GOAL NUMBER 4

Develop Products Which Will Increase Our Volume At The Expense Of Our Competitors

	Resource Allocations* Year				
Program	**1990**	**1991**	**1992**	**1993**	**1994**
Menthol (11.3)	9.8	12.2	13.0	13.8	14.4
Low Tar/High Flavor (16.4)	15.5	17.3	17.6	19.1	19.1
Filter Research (12.3)	11.8	12.8	14.6	12.6	13.5
Domestic Product Support (43.8)	49.1	57.2	65.7	66.2	66.0
TOTALS (83.8)	86.2	99.5	110.9	111.7	113.0

*Current resources are given in parenthesis after each program.

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TABLE 20

STRATEGIC GOAL NUMBER 5

Identify New Product/Process Concepts and Develop Products/Processes For The International Market

Resource Allocations*

Year Program	1990	1991	1992	1993	1994
International Product Support (24.4)**	24.4	26.2	30.3	34.2	36.5
TMCI BL Process Development (1.5)	0	0	0	0	0
Reduced Tar & Nicotine (2.0)	2.0	2.0	2.0	2.0	1.8
Filter Research (5.3)	6.2	6.3	6.2	7.2	7.1
TOTALS (33.2)	32.6	34.5	38.5	43.4	45.4

*Current resources are given in parenthesis after each program.

**Does not include the following PMPI resources for 1990-1994:

Cigarette Development	18.0
Product Evaluation Division	2.0
Cigarette Testing	22.0
Total	42.0

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

particularly charcoal filtered cigarettes for the Far East.

Strategic Goal Number 6 - Basic Research

Nine programs are listed in Table 21 which cover areas of basic research currently being pursued in PM USA R&D. These programs are of two different types. Five of them, Combustion Research, Flavor Research, Aerosol Research, Selective Separations, and Basic Analytical Research, involve areas of research which, although they support existing programs in many cases, will also develop into major product-related programs in 1991 and beyond. As a consequence they will require increased resources during the plan period. One such program involves the development of a cigarette which will burn at a lower temperature which is described in more detail in the following paragraph.

Significantly lowering the combustion temperature of tobacco is a challenging assignment that would have a number of benefits. Not only would it address the fire-safety issue, but more importantly lowering the combustion temperature would prevent the formation of the vast majority of substances which constitute the "biological activity" of tobacco smoke. This approach would accomplish these objectives, yet still provide the customer a cigarette no different in appearance than the one he is currently smoking. To accomplish this objective, we must develop significant new technology involving the combustion of organic materials (Combustion Research), develop a thorough understanding of the manner in which tobacco flavor is formed and delivered (Flavor), and selectively remove certain components of tobacco or add certain flavor precursors (Selective Separations).

Other key product concepts are also addressed by these basic research areas. The group working on **aerosol research** is developing techniques which can enable us to produce a thermal water-based aerosol. This work has immediate application to Sigma and Beta. In addition, however, the technology being developed is essential for the design of a conventional cigarette which will deliver an aerosol from exhaled smoke that will either rapidly disperse or which would be non-visible. This will enable us to address the entire ETS challenge rather than focusing only on sidestream. With respect to sidestream reduction, despite our current successes, we need to address the basic problem; namely, to restrict the combustion of tobacco so that it takes place only during the puff. Technology which could accomplish this objective is being developed for Beta; that is, the flavor dot matrix. Transfer of this technology to a conventional cigarette will require the development of novel flavor systems requiring considerable basic research in **flavors**. Lastly development of tobacco flavoring systems as well as optimizing the subjectives of mainstream smoke for new products will require considerably greater understanding of smoke composition. New analytical techniques will be required to accomplish this goal which will require **basic analytical research** to develop them.

The remaining four basic research programs, Consumer Testing Research,

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TABLE 21

STRATEGIC GOAL NUMBER 6

Provide A Broad Foundation of Basic Research That Will Generate New Product Concepts in 5-15 Years

	Resource Allocations* Year				
Program	**1990**	**1991**	**1992**	**1993**	**1994**
Combustion Research (2.0)	2.2	5.0	7.7	7.4	9.2
Mass Burn Control					
Project Tomorrow					
Pyrolysis Temperature Control					
Cigarette With Low Burn Temperature					
Flavors (7.8)	8.2	13.6	16.7	18.2	18.8
Thermal Flavor-Release					
Sigma/Beta					
Ambrosia					
Flavor Formation Studies					
Cigarette With Low Burn Temperature					
Fragrances					
Ambrosia					
Volatile Flavors					
Cigarette with no ETS					
Aerosols (3.7)	3.3	3.6	3.4	4.0	4.0
Formation Mechanisms					
Sigma/Beta					
Reduced Sidestream					
Cigarette with Low Combustion Temp.					
Short Lived Aerosols					
Cigarette with No ETS					
Selective Filtration					

*Current resources are given in parenthesis after each program.

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TABLE 21 (Continued)

STRATEGIC GOAL NUMBER 6

Program	Resource Allocations* Year 1990	1991	1992	1993	1994
Selective Separations (2.3)	3.6	3.8	5.6	7.5	8.1
Supercritical Fluids					
Project ART					
TSNA					
Membrane Separation					
Cigarette With Low Burn Temperature					
Project ART					
Consumer Testing Res. (5.7)	6.6	6.9	7.5	7.5	8.8
Regression-Based Modelling of Liking					
Stochastic Discrimination Models					
Cost/Benefit Evaluation					
Quantitative Modelling of Market Dynamics					
Measurement & Sensing of Physical & Chemical Characteristics (2.2)	3.1	3.7	5.0	7.4	6.6
Process Control Systems					
Optical Processing					
Project ART					
Adhesive Application					
Biological (4.5)	4.5	5.9	6.0	8.6	9.0
Antibodies					
New Analytical Methods					
Biosensors					
Process Control Systems					

*Current resources are given in parenthesis after each program.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 21 (Continued)

STRATEGIC GOAL NUMBER 6

	Resource Allocations* Year				
Program	**1990**	**1991**	**1992**	**1993**	**1994**
Computing Systems (4.4)	4.4	5.1	5.4	5.4	5.4
Expert Systems and Neural Networks					
Process Control					
Optical Computing					
QA Inspection					
Basic Analytical Research (0)	0	0	0	2.4	4.8
New Analytical Methods					
TOTALS (32.6)	35.9	47.5	57.3	68.4	74.7

*Current resources are given in parenthesis after each program.

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Measurement & Sensing of Physical & Chemical Characteristics, Biological Research, and Computing Systems, either support on-going programs or are directed toward the development of new technology to support current and future operations. Consumer Testing Research is directed toward continually refining our methods of product evaluation in order to improve our ability to make predictions about the potential success of new product prototypes. Measurement & Sensing of Physical & Chemical Characteristics involves the development of remote sensing techniques for process control. An example of a recent accomplishment in this area is the development of a circular dichroism (CD) detector to determine the extent of nicotine extraction during the ART process on-line. Two specific areas of new technology are listed under Biological Research. The first is the use of antibody technology as a means of developing rapid, automated analytical techniques. Work on a nicotine antibody is already in progress. Secondly, biosensors constitute an emerging technology that allows remote sensing of a particular chemical component with high specificity. For example, a system could be established which would detect incipient spoilage of RL long before it would be detectable by other procedures. Lastly, the use of expert systems and neural networks is anticipated to grow rapidly over the next five years. These techniques increase the role that computing systems will have in process control and other areas. Optical computing is a technique that will be explored as a QA inspection tool.

Resource Allocations

Table 22 shows the projected resource allocations for PM USA R&D through 1994. The first row shows the total of directly allocated personnel taken from the summary sheets in Appendix I, the second row the total number of support people taken from the same summary sheets, and the third row the total of both categories. A total of 43 individuals, in an executive and administrative category, is added to yield the total head count. The last row shows the total increase in projected head count for each year. These numbers are as follows: 1990, 3 individuals all in support; 1991, 20 individuals including 8 in support; 1992, 17 individuals including 7 in support; 1993, 5 individuals including 2 in support; and 1994, 1 individual.

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Source: https://www.industrydocuments.ucsf.edu/docs/rrpk0000

TABLE 22

Projected R&D Personnel Requirements Over The Plan Period

	1989	1990	1991	1992	1993	1994
Directly Allocated	333.90	333.40	342.20	349.40	351.50	352.50
Support	197.10	200.60	211.80	221.60	224.50	224.50
Sub-Total	531.00	534.00	554.00	571.00	576.00	577.00
Exec. & Admin.	43.00	43.00	43.00	43.00	43.00	43.00
Total	574.00	577.00	597.00	614.00	619.00	620.00
Increase Over 1990 Budget	-	0	+20	+17	+5	+1
Cumulative Increase Over 1990 Budget	-	0	+20	+37	+42	+43

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E. FINANCIAL ASPECTS

The R&D budget over the plan period is shown divided by cost center in Table 23 in both constant and inflated dollars. The total budget excludes contributions and Science and Technology. Since the budget is based upon the total number of people, it remains constant, in constant dollars, in 1990, and then increases proportionally to the added head count for the remaining four years. Table 24 shows the budget divided by Strategic Goal.

F. Recommendations

Action Plans

Table 10 lists two areas in which PM USA R&D needs to improve identified through internal situational analysis. Summarized below are steps which have been taken to make improvements in these areas during 1989, and action plans to continue improvements.

1. Technology transfer within R&D and between R&D and other Operations Departments can still be improved further.

   The situation with respect to barriers to technology transfer within R&D has improved dramatically. During the past two years a number of individuals on the senior technical staff have been given assignments which involve working across Divisional and Directorate lines. These individuals have developed an understanding of the problems unique to the different areas and have done an excellent job in facilitating communication. In addition a number of the priority programs are now being carried out with an informal type of matrix management which encourages close cooperation between different areas within R&D. Examples of such projects are Sigma/Beta, Paper Technology, and ART.

   Progress has been somewhat slower with regard to barriers to technology transfer between R&D and other departments. Considerable emphasis has been placed on using the R&D quarterly planning meetings as a vehicle to assist with technology transfer. Presentors have been asked to stress technology transfer issues, and steps have been taken to ensure that representatives are present from other Operations Departments so that they are alerted at the early stages about possible new technologies. The Technology Assessment Working Committee has also become a useful vehicle for technology transfer issues. In the final analysis, however, implementation of technology can only be carried out smoothly if R&D adheres to the principle that the group receiving new technology is R&D's customer. In other words, technology transfer will be successful only if the "customer" wants it and only if he receives sufficient assistance to implement it. The Optical Processing Program serves as a good example. Methods for 100% cigarette inspection are being developed; however, we are now

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TABLE 23

PHILIP MORRIS U.S.A.
RESEARCH AND DEVELOPMENT
EXPENSE SUMMARY

(IN MILLIONS)

	1989	1990	1991	1992	1993	1994
EXECUTIVE & DIT	10.2	9.9	11.5	12.3	10.8	11.2
NEW BLEND DEVELOPMENT	-	-	-	-	7.0	7.0
RESEARCH	24.8	25.8	26.4	27.0	27.1	27.2
PROCESS DEVELOPMENT	14.9	15.3	15.3	15.3	15.4	15.4
NEW PRODUCTS	9.6	10.4	11.2	11.5	11.7	11.7
R&D SUPPORT	12.6	12.3	12.5	12.6	12.7	12.7
COMPUTER APPLICATIONS	4.2	3.9	3.9	3.9	3.9	3.9
PM PRODUCTS	3.0	3.0	3.0	3.0	3.0	3.0
TOTAL CONSTANT $	79.3	80.6	83.8	85.6	91.6	92.1
INFLATION (%)	0	4.3	9.0	14.3	20.8	26.8
TOTAL	79.3	84.9	92.8	99.9	112.4	118.9

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TABLE 24

PHILIP MORRIS U.S.A.
RESEARCH AND DEVELOPMENT
SPENDING ALLOCATIONS BY STRATEGIC GOAL

(IN MILLIONS)

	1989	1990	1991	1992	1993	1994
SUPPORT CURRENT BUSINESS	27.3	27.0	27.0	26.0	24.6	24.0
REDUCE HEALTH CONCERNS	19.5	20.5	20.6	21.1	20.6	20.4
REDUCE ETS	10.1	9.8	8.8	7.5	6.6	6.3
INCREASE VOLUME	12.5	13.0	15.0	16.6	16.4	16.7
INTERNATIONAL MARKET	5.0	4.9	5.2	5.8	6.4	6.7
BASIC RESEARCH	4.9	5.4	7.2	8.6	10.0	11.0
EXECUTIVE & ADMINISTRATIVE	5.2	5.3	5.3	5.3	5.2	5.2
NEW BLEND DEVELOPMENT	-	-	-	-	7.0	7.0
TOTAL (Constant $)	79.3	80.6	83.8	85.6	91.6	92.1

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asking the question to our potential customers if they need such a method. We need to involve the departments who will implement this technology into the program now, not when development is completed. In 1990 Optical Processing will be used as a model for well planned technology transfer. Individuals from QA, Manufacturing, and Engineering will be involved in the program at this time, and members of R&D will be assigned to work with QA personnel in establishing the methods in our plants.

2. Lack of knowledge of cigarette manufacturing and processing by bench scientists; however, improvements are being made.

   The Scientist Orientation Program was established in 1989 with the objective of providing selected scientists exposure to tobacco processing and cigarette manufacturing. Mr. Mike Penn, from the Biochemical Research Division, and Mrs. Diane Leister, from the Physical Research Division, were assigned as the first participants in this program. Mike has been working with the Semiworks engineering group since July, 1989. In addition to specific project tasks aimed at supporting the Semiworks operations, Mike has also been given assignments which will provide him with an understanding of all the major tobacco primary processing steps. Diane was assigned to the Tobacco Materials Division in September, 1989, and has been working with the DIET process in D Pilot Plant. At the end of November she will move to the Reconstituted Tobacco Development group to obtain experience with tobacco sheet making processes. Feedback from these two participants indicate that this new Program is quite successful, and present expectations are to continue with it.

   The Scientist Orientation Program addresses half of the action plan developed in the 1988 R&D Strategic Plan directed toward increasing our bench scientists'' knowledge of tobacco processing and cigarette making. The other proposal was to develop a short course which could be given to the entire staff over a period of a number of years which would at least acquaint them with an introduction to these important phases of our business. This will be addressed in 1990.

Tactics

The tactics for carrying out the 1989 R&D Five Year Strategic Plan are the major programs that must be put into place in order to achieve the Plan's objectives. Table 25 lists these programs for each year. The tactics for achieving program objectives are, of course, the Operational Plans that are developed for each program.

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TABLE 25

MAJOR PROGRAMS FOR THE PLAN PERIOD

1990	1991	1992
Project ART	Project ART	Project ART
Sigma/Beta	Sigma/Beta	Sigma/Beta
Domestic Prod. Support	Domestic Prod. Support	Domestic Prod. Support
International Product Support	International Product Support	International Product Support
Operations Support	Operations Support	Operations Support
Filtration Research	Filtration Research	Filtration Research
Paper Technology	Paper Technology	Paper Technology
Project Tomorrow	Project Tomorrow	Project Tomorrow
Optical Processing	Optical Processing	Optical Processing
Low Tar/High Flavor	Low Tar/High Flavor	Low Tar/High Flavor
TSNA	TSNA	TSNA
LBA	LBA	LBA
Second Generation DIET	Second Generation DIET	Second Generation DIET
Cast Sheet RCB	Cast Sheet RCB	Cast Sheet RCB
Project Pact	Project Pact	Project Pact
Project Ambrosia	Project Ambrosia	Project Ambrosia
	Cigarette with Low Combustion Temp.	Cigarette with Low Combustion Temp.

1993	1994
Project ART	Sigma/Beta
Sigma/Beta	Domestic Prod. Support
Domestic Prod. Support	International Product Support
International Product Support	Operations Support
Operations Support	Filtration Research
Filtration Research	Paper Technology
Paper Technology	Project Tomorrow
Project Tomorrow	Optical Processing
Optical Processing	Low Tar/High Flavor
Low Tar/High Flavor	LBA
TSNA	Second Generation DIET
LBA	Project Ambrosia
Second Generation DIET	Cigarette with Low Combustion Temp.
Project Ambrosia	Cigarette with no ETS
Cigarette with Low Combustion Temp.	

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